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TRANSACTIONS

OF THE

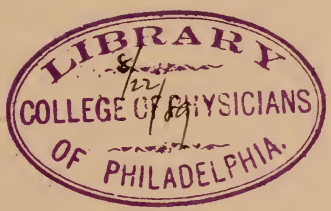
AMERICAN ORTHOPEDIC ASSOCIATION

TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION

VOLUME I.



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1889

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CONSTITUTION AND BY-LAWS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

CONSTITUTION.

I. Name.

This Society shall be called the American Orthopedic Association.

II. Objects.

The purpose of this Association shall be the advancement of Orthopedic science and art.

III. Members.

The members shall be graduates in Medicine in good professional standing, who are especially interested in Orthopedic science and art.

Candidates for membership shall have been engaged in the practice of medicine for at least three (3) years, and shall have given evidence of satisfactory scientific attainments.

IV. Forfeiture of Membership.

The Association shall have power to declare forfeiture of membership in case of any member who ceases to exhibit an active interest in the science of Orthopedic Surgery. Any active member of the Association who shall absent himself from three (3) consecutive Annual Meetings shall be dropped from the roll of membership, unless he shall be able to give satisfactory reasons to the Association for his dereliction.

BY-LAWS.

I. Election of Members.

There shall be a Committee on Membership, consisting of five (5). All nominations shall be made in open meeting by two (2) members of the Association, and shall be referred to the Committee on Membership, who may report on each name as they shall think proper; such report to be

made at the next Annual Meeting following that at which the nomination is made. But the proposers of any member may, after the report of this Committee has been received, bring such name before the Association.

The Secretary shall soon after each Annual Meeting send to each member of the Association a list of the names of all candidates proposed for membership, together with the names of proposers and of the members of the Committee on Membership.

A vote of three fourths of the members present at an Annual Meeting shall be requisite to an election.

The election shall be by ballot.

Every member shall sign the Constitution and By-Laws.

Honorary members may be chosen by the Association in the same manner as active members. They shall enjoy all the privileges of active members, except voting and election to office and appointment on Business Committees. They shall, if practicable, sign the Constitution and By-Laws.

II. Officers.

The officers shall be a President, two Vice-Presidents, and a Recording Secretary, who shall also be Treasurer. Their terms of office shall be for one (1) year. There shall be a Corresponding Secretary, whose term of office shall continue from year to year, unless limited by the Association.

The President shall conduct the meetings of the Association.

The Recording Secretary shall keep the minutes, carry out the instructions of the Association in respect to its transactions, and call its meetings. He shall also take charge of moneys for the Association.

The Corresponding Secretary shall conduct all foreign correspondence.

The President and Recording Secretary shall be elected at the close of each Annual Meeting, to manage the affairs of the Association during the interim, and to serve at the ensuing meeting.

III. Meetings.

The Association shall hold its meetings annually on the third Wednesday of June, at such place as may be determined; the time and place of meeting to be advertised by the Secretary, and notice to be sent to members. Eight (8) members shall constitute a quorum.

IV. Proceedings.

The proceedings of the Association shall be issued in pamphlet form.

There shall be a Publication Committee of two (2) to act in connection with the Recording Secretary in publishing the transactions.

V. Fees.

The initiation fee shall be ten ($10.00) dollars; the Annual dues, five ($5.00) dollars.

VI. Expulsion of Members.

Any member may be expelled for cause by a three-fourths vote of those present at any Annual Meeting.

No action in matters of discipline shall be taken at any session of an Annual Meeting at which there shall be present less than three fourths of the members registered as attending such Annual Meeting. A vote of three fourths of the members thus present shall be necessary for expulsion.

VII. Order of Business.

1. Reading records of previous meeting.
2. Appointment of Committees.
3. Report of Treasurer.
4. Report of Committees.
5. Election of new members.
6. Written communications.
7. Stated discussions.
8. Verbal communications.
9. Incidental business.

VIII. Alterations of By-Laws.

A vote of three fourths of the members present at any Annual Meeting shall be requisite for an alteration of the Constitution.

A vote of a majority of the members present at an Annual Meeting shall be requisite for an alteration of the By-Laws.

Propositions to amend or alter the Constitution or By-Laws must be made at one session of the Annual Meeting, and acted upon at a subsequent session of the same Annual Meeting.

STANDING RULES.

I. Whenever a candidate is proposed for membership, both the proposer and seconder shall furnish letters setting forth the claims of such candidate for membership.

II. Names of members in arrears to the Association for three (3) years shall be stricken from the list three months after the notification of this rule has been served upon such members, except in the case of those absent from the country.

III. The Secretary shall, about April 1, send a request to each member to forward the titles of such papers, specimens, or apparatus as he desires to present at the next meeting of the Association. Such titles shall be incorporated by the Secretary in the printed call for the meeting, and these papers shall have precedence over all others.

IV. Twenty (20) minutes shall be the maximum time allotted to the reading of any paper, unless by special vote of the Association in each case and by a two-thirds majority. Any paper requiring more than twenty minutes for its reading shall be presented in abstract under the same limitation to twenty minutes.

V. No paper shall be referred to the Publication Committee unless the paper itself or an abstract of it shall have been presented to the Association at its Annual Meeting by the author in person.

VI. All papers and other communications intended for publication shall be placed in the hands of the Secretary before September 1; proofs of the same shall be sent to the several writers, returnable within two weeks. In case of non-compliance with this rule, any paper may be omitted from the published transactions at the discretion of the Publishing Committee.

VII. The President and Recording Secretary shall not have power to incur any debts for the Association exceeding in total the sum of one hundred ($100.00) dollars, unless specially authorized to do so by the recorded vote of the Association.

VIII. All proceedings of the Association, not specified, shall be in accordance with the manual of the House of Representatives.

LIST OF MEMBERS.

Henry W. Berg, M.D.	241 7th Street, New York.
E. H. Bradford, M.D.	149 Newbury Street, Boston.
Buckminster Brown, M.D.	19 Marlborough Street, Boston.
Dillon Brown, M.D.	102 E. 57th Street, New York.
Joseph D. Bryant, M.D.	66 W. 35th Street, New York.
W. B. De Garmo, M.D.	69 Madison Avenue, New York.
Edward Develin, M.D.	138 E. 40th Street, New York.
Charles C. Foster, M.D.	Riedesel Avenue, Cambridge.
V. P. Gibney, M.D.	23 Park Avenue, New York.
E. H. Goodman, M.D.	1509 Walnut Street, Philadelphia.
H. Hodgen, M.D.	500 N. Jefferson Avenue, St. Louis.
A. B. Judson, M.D.	42 E. 21st Street, New York.
Samuel Ketch, M.D.	328 W. 29th Street, New York.
George S. Knickerbocker, M.D.	352 W. 128th Street, New York.
Benjamin Lee, M.D.	1532 Pine Street, Philadelphia.
R. W. Lovett, M.D.	133 Boylston Street, Boston.
James E. Moore, M.D.	Minneapolis, Minn.
Thomas G. Morton, M.D.	1421 Chestnut Street, Philadelphia.
George B. Packard, M.D.	Hartford, Conn.
Roswell Park, M.D.	Buffalo, N. Y.
John Ridlon, M.D.	337 W. 57th Street, New York.
A. Sydney Roberts, M.D.	255 S. 16th Street, Philadelphia.
George W. Ryan, M.D.	114 W. 9th St. Cincinnati, Ohio.
Lewis H. Sayre, M.D.	285 5th Avenue, New York.
Reginald H. Sayre, M.D.	285 5th Avenue, New York.
J. C. Schapps, M.D.	486 Bedford Avenue, Brooklyn.
Newton M. Shaffer, M.D.	28 E. 38th Street, New York.
A. J. Steele, M.D.	2825 Washington Ave., St. Louis.
Charles F. Stillman, M.D.	18th Street and 4th Ave., N. York.
C. W. Stimson, M.D.	68 W. 40th Street, New York.
C. Fayette Taylor, M.D.	201 W. 54th Street, New York.
Henry L. Taylor, M.D.	201 W. 54th Street, New York.
Ap Morgan Vance, M.D.	229 W. Chestnut St., Louisville, Ky.
W. R. Whitehead, M.D.	Denver, Col.
De Forest Willard, M.D.	1818 Chestnut St., Philadelphia.

Corresponding Member.

Bernard Roth, Esq.	London.

PRELIMINARY MEETING.

THE formation of an AMERICAN ORTHOPEDIC ASSOCIATION was first formally discussed at a meeting of gentlemen interested in the subject held at the house of Dr. SHAFFER in New York, Jan. 29, 1887. Dr. GIBNEY and Dr. SHAFFER had independently formed plans for the organization of such an association, and the present meeting was the result of the consolidation of these plans. Dr. GIBNEY was elected Chairman of the meeting, and Dr. LOVETT Secretary.

Dr. SHAFFER spoke of the need of such an association, not only to bring together American orthopedic surgeons, but also to secure a better recognition in Europe for American orthopedic surgery.

The question was discussed at some length by the gentlemen present; and a rising vote was taken, which resulted in ten votes for the formation of such an association, and two against it: two gentlemen did not vote on the question.

Dr. SHAFFER moved that a committee of three should be appointed by the Chair to draw up a constitution and by-laws, and to present them at a subsequent meeting, and that the Chairman of the evening should be the Chairman of that Committee. The motion was carried unanimously, and Dr. GIBNEY appointed Dr. SHAFFER and Dr. L. H. SAYRE to serve with him on this Committee of Organization.

It was voted that this Committee should have power also to settle the conditions of membership, and to invite those whom it saw fit to become members of the Association.

The meeting then adjourned, subject to the call of the Committee on Organization.

TRANSACTIONS

OF THE

AMERICAN ORTHOPEDIC ASSOCIATION.

FIRST ANNUAL MEETING.

HELD AT THE ACADEMY OF MEDICINE, NEW YORK,
JUNE 15 and 16, 1887.

First Day, Wednesday, June 15.

THE meeting was called to order at 3 P. M., by V. P. GIBNEY, M.D., of New York. As temporary chairman, Dr. Gibney made a verbal report concerning the preliminary meetings on organization.

The Association then proceeded to elect a chairman and secretary for the first annual meeting. Dr. GIBNEY was elected Chairman, and Dr. L. H. SAYRE Secretary.

The Secretary gave a brief report of the proceedings of the preliminary meetings on organization, and read certain communications regarding membership.

The Chairman stated that the Constitution and By-Laws would be considered as adopted when signed by the members present. The members present then signed their names to the Constitution and By-Laws which had been drawn up by the Committee on Preliminary Organization.

After some further remarks on organization by Dr. SHAFFER and Dr. MORTON, the Association proceeded to the transaction of scientific business.

Dr. G. B. PACKARD, of Hartford, read a paper on "Hypertrophy of the Lower Extremity."

Dr. T. G. MORTON, of Philadelphia, presented "an instrument for the forcible reduction of club-foot," and made some remarks upon excision of the knee.

Dr. Henry Ling Taylor, of New York, read a paper upon "A Case of Pott's Disease with an Unusual Deformity."

Dr. V. P. Gibney, of New York, made some remarks which he spoke of as "A Clinical Contribution to Diseases of the Shoulder." They were as follows: —

At a meeting of the Orthopedic Section of the Academy of Medicine, February, 1886, I presented a paper on "Chronic Disease of the Shoulder," which was published in the "Medical News," May 1, 1886. A number of cases were presented, and they showed the inefficiency of passive motion as a means of relieving fibrous ankylosis. My aim was to distinguish between those that could be relieved by passive motion under an anæsthetic and those which it was best to treat in some other way. The present contribution does not reach to the dignity of a paper. I have simply taken the liberty of presenting a case or two included in the original paper, and the chief interest now lies in the later developments.

The first patient is a girl who came under my observation in February, 1881. At that time she was fourteen years of age. She reported to me that from childhood the arm had been weak, that the movements of the shoulder had caused pain and a little reflex spasm. She knew no cause. I found an inch atrophy over the shoulder, one and a quarter inches atrophy of the arm, three quarters of an inch at the elbow. The limb was about one quarter of an inch shorter than its fellow. The arc of motion was small. The treatment from this time until the latter part of March of the same year was passive motion, faradism, and occasional poulticing, without much relief. Ether was administered, and free passive motion was made at the shoulder joint. This was in St. Luke's Hospital; and the usual after-treatment, namely passive motion, was employed, and a few weeks subsequently there was very little improvement to be noticed. The hot-water douche and daily manipulations in connection with faradism constituted the treatment for the next few months. Then followed a period of two years, during which time nothing was done; and at the time of my report she was working, was free from pain, and had very little inconvenience from the arm; her shoulder was stiff, however.

The above is the substance of the report made; and recently I have had an opportunity of examining her shoulder, and find that a small cicatrix exists just below the shoulder, and near the outer portion of the infra-clavicular space. She is unable to raise the

arm from the side, and cannot get her hand back to the back part of the head. There is an inch and a half difference in circumference, and an inch and a half between the length of the arms. The cicatrix, she tells me, comes from an abscess which appeared in March, 1886, and remained open five or six months. She had very little pain during this period. It opened spontaneously; a slight discharge continued three or four months. The parts seem now perfectly sound, yet there is still an absence of motion over a very small arc. She has grown in strength, her health is very good, she is at work every day, and tells me that she has very little inconvenience from the arm. She is present to-day; and the condition is, as you will see, about as I have stated.

The next case (Case No. 2 of my former report) is so similar to this that a reproduction of the notes is quite unnecessary. There is this difference, however; namely, that this patient has only recently discovered the abscess, and it consists now of a small tumor in the same locality as in that of the preceding case. This girl had the same treatment as the preceding, with about the same result, and her usefulness is practically the same.

The points of interest in the two cases are the efficiency of the ordinary passive motion, and the final outcome, which any one will recognize as fairly good. They were both undoubtedly cases of bone disease in the neighborhood of the joint, and are submitted for discussion on this occasion.

I have recently had an opportunity of examining another one of the cases reported; namely, that of the clergyman (No. 3 of the former report). I find that under active motion he has completely recovered the use of his shoulder, and he tells me that now one arm is as good as the other. This case, however, was not one of bone disease, but of rheumatic periarthritis. Such cases, where the ankylosis is not great, yield good results to passive motion under ether; but it is difficult to draw the line between those that do result in good from such a procedure and those where we cannot expect good results. The history of the disease should most certainly be a guide. The question of incision is to be considered only in those cases of ostitis like the case presented to-day, and it may be comforting to know that disastrous results do not follow a palliative course.

Such in brief is the report I have to make on this occasion, and no attempt is made at a full discussion of this subject. The cases are given for what they are worth, and it has occurred to me that

they might contribute somewhat to the clinical history of bone disease involving the shoulder joint.

Dr. Judson, of New York, presented a new form of ischiadic crutch, for the treatment of affections of the lower extremity. A perineal strap applied in the region of the ischiadic tuberosity performs the duty of the axillary head of the ordinary crutch. By its use locomotion is rendered convenient; while the affected limb, being pendent, escapes the pressure and violence which attend walking in the ordinary way. When the limb is raised in walking, the weight of the crutch comes on the shoulder of the unaffected side through a shoulder strap; the hands and arms of the patient being entirely free.

In the discussion which took place on the following day, attention was called to the fact that in using the ischiadic crutch the patient's toe rested on the ground. Dr. Judson stated in reply that although the toe reaches the ground, but a trifling part of the weight of the body is received at this point; and the pressure thus produced reaches the affected hip or knee joint indirectly, and only after being modified by the action of the muscles controlling the ankle joint. It was important, however, that the heel should be prevented from reaching the ground, because pressure and violence excited here are transmitted upward directly through the straight bony column composed of the tibia and the femur.

The President. — I would testify to the great convenience of the splint presented by Dr. Judson, which I have used in cases of ostitis of the hip. An advantage which it possesses is an important one; namely, that the pelvic band is very low, rendering the perineal strap almost taut from front to back. Another advantage is the use of the U-shaped piece for better fixation. I have only lately been using a single perineal strap, but I find that my patients go about very comfortably with it. It certainly diminishes the excoriation. The cases in which Dr. Judson uses this splint, namely, cases of disease of the knee joint or of the ankle joint, or other cases in which otherwise the axillary crutch would have to be used, I think, are much better off with this instrument than the axillary crutch.

Dr. Ketch asked whether the object of the instrument was to throw the weight of the body upon the foot, and remarked that the boy who was wearing the instrument touched the ground with the toe.

Dr. Judson replied that it was the intention to take the weight

of the body off of the foot. The toe touched, as with most apparatuses, but not so much to support the limb as to steer it.

Dr. A. S. Roberts, of Philadelphia. — Mr. President: There are two things about this splint which give it an advantage over the ordinary form of Taylor's splint. First, we avoid in its manufacture an expensive ratchet movement. I find in dispensary practice that persons are just as likely to turn the ratchet the wrong way as the right, if they use it at all. Second, the perineal band in this instrument possesses a decided advantage. Where we have the elements of ignorance and of expense to consider, especially in dispensary practice, I think this splint of Dr. Judson's has those points of simplicity which strongly recommend it.

Dr. Stillman, of New York. — Mr. Chairman: As a walking-splint, this is one of the best that I have seen; but there appears to be no protection for the joint except that, when the boy walks, it takes the weight off the joint. I think better results may be obtained by fixing the joint more perfectly.

The Chairman explained that Dr. Judson did not present his splint as one specially adapted to hip-joint cases, but simply as an ischiadic crutch. He, the Chairman, agreed with Dr. Stillman, that in the acute stage of hip-joint disease it was desirable to obtain more perfect fixation than this splint caused.

Dr. A. S. Roberts, of Philadelphia, then presented a "Plantar spring for use in flat foot."

Dr. E. H. Bradford, of Boston, read a paper on "A Case of Functional Torticollis from Defective Eyesight."

The meeting then adjourned.

The Association met for the second day's session on the afternoon of June 16, 1887. At 2.30 the meeting was called to order by Dr. Gibney, and the records of the previous meeting were read and accepted.

Dr. H. Hodgen, of St. Louis, opened a discussion on "Early Aspiration of Psoas Abscess from Caries of the Spine." He said: —

I wish simply to call attention to the treatment of psoas abscess from disease of the spine, in order to bring forth the opinion of the members of the Association.

The treatment of which I shall speak is not novel; it is old, but it has been neglected. I think, in general, the treatment of psoas abscess accompanying Pott's disease may be divided into three heads:

(1) No treatment at all, or so-called expectant treatment, allowing the abscess to take care of itself. (2) Opening the abscess by free incision, allowing of thorough drainage. (3) The method which I prefer; namely, early and frequently repeated aspiration of the abscess. By "early" I mean as soon as diagnosis of abscess can be made, and not waiting for bulging of the tumor, but proceeding to introduce the needle as soon as fluctuation becomes evident.

The principal objections to allowing the abscess to take its own course I think may be summed up as follows: In the first place, there is destruction of tissue; second, there is interference with function; third, there is, to say the least, inconvenience to the patient, if not actual pain — but I think abscesses are painful; fourth, you do not know where the abscess will burrow and point. It may burrow under Poupart's ligament, in the gluteal region, in the groin, and do no harm; yet it may empty into the bladder or intestine, or, as I believe occurred in one of my cases, it may open into the cavity of the hip joint on the same side.

Dr. H. H. Mudd, of St. Louis, and myself have now treated five cases of psoas abscess dependent upon caries of the spine by early aspiration, aspirating from two to five times, and in each case the result has been good. The history of one case is the history of all, excepting with regard to the number of aspirations.

The last case was that of a young lady, sixteen years of age, in which we withdrew on the first occasion about five hundred cubic centimetres of pus. She was kept in bed, and at the end of four or five days about fifty cubic centimetres of pus were withdrawn. She was put into a solid plaster-of-paris jacket, as were the other cases. I saw her one year after the jacket had been removed; she had worn the jacket two years, and had no trouble whatever. There is no spasm of the psoas, and absolutely no evidence that there had ever been a collection of pus in the psoas muscle.

I do not think anybody will claim that this is an absolute cure for these abscesses, but I do claim that it is possible after aspirating a psoas abscess that it may stop at that point if there is no sequestrum. It may not; you may have to repeat the aspiration four or five or seven times. Beyond that I do not go; I would apply the plaster-of-paris jacket and give up aspiration, allowing the abscess to take care of itself or opening it freely. But I believe that in some cases the condition may be changed from a very uncomfortable one to a comparatively comfortable one.

By aspirating the abscess the same result takes place as if it were

allowed to open spontaneously; it is drained, and may heal before any more destruction of tissue takes place. In case this result does not follow, it does not interfere with allowing the abscess afterward to empty itself in its own way, nor does it interfere with opening the cavity by free incision. So I think we should try, first of all, to reach the abscess by the needle, for the procedure is unattended by any danger.

In the case referred to of probable perforation of the abscess into the hip joint, the patient was a boy six years old, who came to my clinic limping and having evident hip-joint disease. I am ashamed to say that I did not have the back stripped of clothing and make a thorough examination. There was a sinus in the ischio-rectal region which at first I took for an ordinary fistula in ano, but on probing it I found that it ran upward and outward instead of toward the gut. The probe did not enter far enough to reach the joint. A week or two later the sister of the patient came back with him and gave his history in good English. She said that, some time before, the boy had had a swelling in the right leg, extending up to the crest of the ilium; that when it reached to near the anus it broke and the swelling went down. About this time the patient commenced to limp. It was on account of that limp that the child was sent to me, and not because of any trouble with the back. The child now has pretty well marked Pott's disease in the lower dorsal or upper lumbar region.

I have two theories to offer in explanation of the hip disease. The first and most probable one is that the pus burrowed and ulcerated through the cartilage which later in life goes to form the three bones of which the acetabulum is composed. If this was not the case, then it is probable the pus followed along the psoas muscle, and set up a bursitis which connected with the joint. It is the only case in which I have been able to trace with reasonable certainty a connection between the psoas abscess and disease of the hip joint by perforation.

Dr. Ridlon, of New York. — Mr. President: Dr. Hodgen has said — and I have heard the opinion expressed repeatedly by surgeons — that if any abscess connected with a diseased joint be aspirated once, twice, or more times, it will cease to refill, and gradually dry up and disappear. Now, the fact that one or two, or even fifty, cases have so resulted does not prove that a few aspirations will generally check the discharge arising from diseased bone. I have had an extensive experience with the let-alone method, and I have

repeatedly seen large abscesses, without any reason so far as I could determine, dry up and disappear. I have two such cases in mind at this moment; in one the abscess in the iliac fossa entirely dried up, and in the other it has disappeared almost completely.

I believe in letting the abscess alone and supporting the spine with a brace. The fact that the abscess may dry up and disappear after aspiration does not prove that the aspiration was the cause of it.

Dr. KETCH, of New York. — Mr. President: A word in furtherance of what Dr. Ridlon has said, and of what was said by Dr. Judson in a paper on the treatment of abscesses connected with hip-joint disease, read before the Orthopedic Society. He maintained — and if I remember correctly it was the view held by all the orthopedists present — that the plan of non-interference was best. On the contrary, all the general surgeons present advocated very active procedures, either in the way of completely opening and scraping out and draining the abscess cavity, dressing it antiseptically, or other similar means.

What has struck me forcibly is that patients who have an abscess connected with joint disease or spinal disease get along much better when they wear a comprehensive support; the abscess seems to pursue a much more benign course.

Recently I had the opportunity of seeing a case of double psoas abscess in a child, there being a collection of pus in both iliac fossæ. The child was doing well, and it was decided by Dr. Shaffer and myself to let the abscesses alone. In another case seen with Dr. Sayre, the little girl had Pott's disease in the dorso-lumbar region, attended with a great deal of pain. The abscess opened and discharged through the vagina. The child at present, so far as the abscess is concerned, is doing perfectly well.

My impression is that now, since we give comprehensive support, these abscesses are much more benign than formerly.

Dr. E. H. BRADFORD, of Boston, read a paper on "Lumbar and Psoas Abscesses treated by Incision and Drainage."

Dr. Bradford also showed, on behalf of Dr. Lovett, of Boston, a specimen of acetabular hip disease.

The history of the case was as follows: The boy was brought to the out-patient department of the Children's Hospital when five years old, in January, 1881, with symptoms of hip disease in the right hip joint. He was treated for two years by a modification of Thomas hip splint and without extension. The acute symptoms

disappeared, and in 1884 he was allowed to go about on a high shoe, the well limb, and crutches. In May, 1886, he fell, and suffered for a time with renewed acute hip symptoms, — night cries. This, however, only lasted a few weeks, and on February, 1887, his condition was recorded as fairly good. He could walk without splints, but was directed to use crutches as a protection for a while.

The following measurements were recorded: Length of right limb, 24½ inches; of left limb, 25¼ inches. Circumference of right thigh, 11½ inches; of left thigh, 14 inches. Circumference of right calf, 9 inches; of left calf, 10½ inches. No motion in joint. Permanent flexion of 30°.

May 18 he was seized with tetanus without apparent cause, the symptoms developing gradually in the following three days and first manifest by a spasm of the muscles of the jaw. He died May 28.

On post mortem the examination showed, besides lesion relative to the tetanus, the following condition of the hip: The head of the femur had been partially absorbed at the upper and inner portion of the joint; the femur was hard and firm, as if thoroughly solidified by the cicatricial condensing ostitis. At one part there was a small sequestrum which communicated with the acetabulum; the acetabulum was disorganized and distorted in shape, and showed evidence of rarefying ostitis in places. It was perforated, and on the pelvic side there was a mass of granulative tissue and caseous foci. The joint cavity was completely obliterated.

The case was evidently one in which the greater part of the disease was acetabular, and where the femur had recovered solidity and strength. There had been sufficient solidity in the greater part of the acetabulum to allow the support of weight, but a tuberculous focus with a small bony sequestrum was left. The only outlet for the sequestrum was through the acetabulum into the pelvis.

Whether extension would have prevented the spread of the acetabular disease it is impossible to determine now; but it will be noticed that the perforation of the acetabulum is what would have occurred by a continued upward pressure of the relatively solid femur, after absorption of the diseased portion of the femur. The specimen will serve as an excellent example of acetabular disease.

In the discussion on the history of a case of hip-joint disease, with specimens, Dr. L. H. Sayre, of New York, said: —

Mr. President: As related to the case presented by Dr. Bradford, I have here a patient whose history may be of some interest. He is twelve years of age, of healthy parents. About two years ago he

consulted Dr. Henry L. Taylor for supposed hip-joint disease. Dr. Taylor has kindly furnished me with the following notes : —

The boy apparently recovered perfectly after circumcision, and remained well until last Thanksgiving Day, when he suddenly became lame. He was brought to me about the middle of January, at which time the right thigh was adducted across the middle of the left, was everted, and very slightly flexed on the pelvis. The knee was perfectly straight. There was not the ordinary deformity which accompanies the third stage of hip disease. There was very little tenderness in the joint upon pressure in any direction, excepting very little when the trochanter was driven inward to make pressure on the base of the acetabulum. There was a great amount of induration over the posterior gluteal region.

The boy was put to bed, and a weight and pulley applied for the purpose of bringing the leg into a better position. I was inclined to look upon the case at that time as one of ostitis of the ilium. I did not think the joint itself was then involved. After the boy had been in bed about three weeks, the temperature rose to 101.5° F. in the morning, and to 103° in the afternoon. There were some night sweats and loss of appetite. Fluctuation was now discovered in the indurated tissue over the right buttock. On the 14th of February last I cut into this abscess, which was situated under the gluteal muscles. About eight ounces of pus were evacuated, and the cavity thoroughly cleansed. There was no bone or detritus of any kind indicating disease of the joint. The capsule of the joint was ruptured, and the head of the femur was seen moving freely in its articulation. The head of the bone appeared to be perfectly normal, as did also the cartilage, which was smooth and shiny. But on moving the thigh some gelatiniform material escaped through the opening in the capsule of the joint; and as I have always regarded that as a sign of dead bone existing somewhere, I proceeded to excise the hip. I removed the head of the femur, and then found that the inner side of the acetabulum was carious, and scraped it. The wound was then prepared for thorough drainage, and stuffed with iodoformized gauze.

Examination of the head of the femur after excision showed that while the cartilage appeared healthy, it was in fact entirely separated from the bony structure except at one or two points. The ligamentum teres was entirely destroyed. There was an abscess perforating the head of the femur.

The boy now goes around with a splint. The wound is not

entirely closed. Some small pieces of bone have come out, for I was unable to cleanse the acetabulum of all diseased structures at the time of the operation.

Dr. Bradford. — Mr. President: I would ask Dr. Sayre whether he expects to accomplish a perfect cure by excision when there is a great amount of primary acetabular disease. As seen in this case, it is pretty difficult to clean out the acetabulum thoroughly.

Dr. L. H. Sayre. — Mr. President: Some of the best results which I have ever seen after excision of the hip joint were in cases in which I could discover no shortening, in which the motions were freer than in the opposite joint, and in which there was extensive disease of the acetabulum, a large proportion of the acetabulum having been removed. I do not think the presence of disease in the acetabulum should necessarily prevent a good recovery. You may not clean out the acetabulum perfectly, and you cannot close up the wound and make a thoroughly antiseptic operation, but you can secure drainage and obtain a good result.

I have never before excised a joint in exactly the condition of that of this boy. The operation was commenced as an exploratory one. I may add that there is an inch and a half shortening. The boy's sister says he has always walked as if he had a wooden leg; he never put his right foot across his left thigh; but he complained of nothing, and ran about with other boys.

Dr. Bradford. — Mr. President: I think it very likely I should agree with Dr. Shaffer in theory and treatment; but I do not think it can be affirmed that excision of the hip is impossible. Of course you cannot put the saw on one side of the knee and then on the other, as you can at the knee; but you may remove the head of the femur, and then by the thorough use of the curette and chisel remove the acetabulum completely. Schede's results, I think, are due to operating in that manner. I am not sure that I have excised a hip with extensive acetabular disease thoroughly; but I am quite confident that Schede and Volkmann have done it.

Dr. L. H. Sayre. — Mr. President: In all cases of excision of the hip joint seen by me in which there was much disease of the acetabulum, there was marked thickening of the internal periosteum, so that there was little danger of perforating the pelvic cavity itself. I am not a believer in early excision, or in excision before giving the patient the benefit of the best mechanical treatment. Excision should be the last step. If the disease resists all treatment, — goes steadily from bad to worse in spite of mechanical

treatment and hygienic and therapeutic measures, — the discharge increases, and the patient runs down, in such a case I would resort to excision.

Dr. L. H. Sayre, of New York, exhibited a patient upon whom excision of the hip joint had been performed.

Dr. John Ridlon, of New York, read a paper upon "Two Cases of Pott's Disease," illustrating the difficulty of diagnosis between upper dorsal and lower cervical caries in very young children.

Dr. H. L. Taylor, of New York, presented an apparatus for the treatment of Pott's disease, devised by Dr. C. Fayette Taylor. It was presented mainly because the apparatus known by his name and figured and described in surgical works (often incorrectly) has since its invention, and especially in the last fifteen years, undergone considerable modification and improvement in the way of definiteness and precision of action, though the principle of antero-posterior leverage support remains unchanged.

The apparatus presented is the form which has been in use in Dr. Taylor's practice for twelve years or more. It differs from the one first devised by him and presented at the Fifty-sixth Annual Meeting of the New York State Medical Society, held at Albany, Feb. 3, 4, and 5, 1863, and figured in the reprint of his paper, then read, in the following points: —

1. The parallel vertical bars have been lengthened, and end in hooked pieces passing well over the shoulder near the neck.

2. The hinges differ somewhat in construction, and are screwed to the bars, being retained solely for the purpose of rendering modification of the apparatus more easy.

3. The circular hip band is discarded, and replaced by a stiff steel band having the shape of an inverted U, to which the vertical bars are attached at their lower ends. The ends of the ∩-shaped band are fitted into the post-trochanteric sulcus on either side, and together with the hooked pieces at the root of the neck fix the apparatus laterally, besides assisting in antero-posterior and vertical fixation of the apparatus. The ends, being points of contact with the skin, are covered with hard rubber plates.

4. Hard rubber pads are used, instead of the soft pads formerly employed.

5. Instead of the strap encircling the arm, formerly used to get a fixed point for counter-force at the top of the chest in front, a "chest-piece" is used, consisting of two ear-shaped or triangular hard rubber pads, fitted under the outer half of the clavicles, over

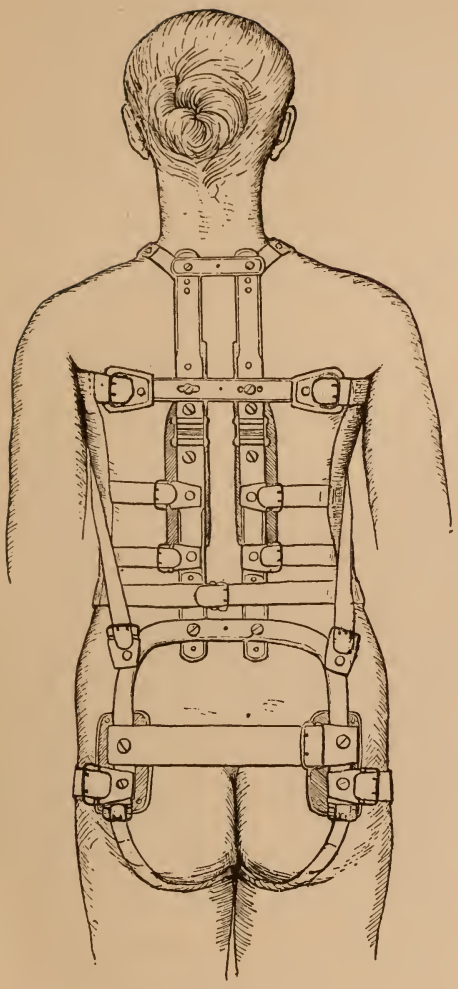

Fig. 1.

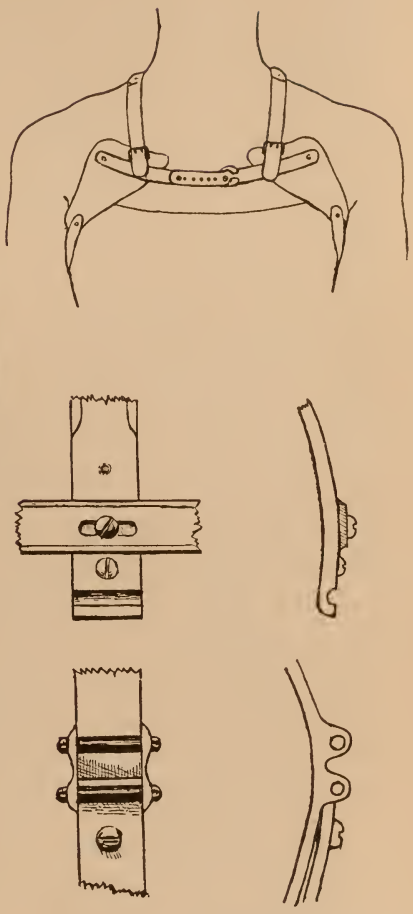

Fig. 2.

the pectoral muscles, and joined by a stiff steel bar, curved forward so that the chest between the plates is not touched. The bar is so contrived that the distance between the plates may be increased or diminished at will. The chest-piece being in position, it is buckled to straps coming from the ends of the shoulder-hooks above; below it is strapped to a buckle at the angle of the hip band, on either side, thus leaving the arm free and the axilla untouched.

6. The apron, which holds the whole apparatus forward, reaches to the posterior border of the axilla on either side, and from the trochanter to the arm vertically, and is secured by appropriate straps and buckles to the apparatus.

It is to be understood, of course, that appropriate modifications of the structure of the apparatus are made for disease in the different regions of the spine, and for the character and amount of the deformity. Most cases of disease above the seventh dorsal will require Dr. Taylor's circular pivoted head-support, which is easily fitted to this apparatus. The different points alluded to are shown in the cuts.

Dr. H. L. Taylor, of New York, also presented an apparatus, devised by Dr. C. Fayette Taylor, for overcoming adduction of the thigh following hip disease, or old luxations, — in fact, any condition excepting true bony ankylosis. Dr. Taylor had used for about fourteen years various forms of apparatus for producing and maintaining adduction by means of a carefully fitted crutch bearing in the opposite groin and jointed to the inner knee plate of a stiff or jointed instrument, and operated with a key and ratchet or toggle-joint. These devices have been found vastly more efficient than the adduction screw and hip band, which have been discarded.

The apparatus presented was simply the shank of the long hip splint, ending above in properly shaped spreading bars bearing a perineal strap, fitted into the groin opposite to the adducted thigh. The apparatus is applied to the inside of the adducted limb, and fastened below by a strap and buckles to adhesive plasters. Screwing out the apparatus by the key produces a direct and well-nigh irresistible abducting force, which is perfectly under control.

This apparatus is to be worn in bed, and a few days to a week or two suffice even for obstinate cases.

When the leg is sufficiently adducted, a retaining apparatus with adduction crutch, jointed to the knee plate, is to be worn in some cases to maintain the position.

A case of adduction to about twenty degrees from a dislocation upon the dorsum of thirty years' standing, necessitating an extra sole of three and three quarters inches in thickness, was completely overcome in two weeks, and the sole reduced to one and three quarters inches, which represented the actual shortening. This was done with a less perfect apparatus than the one shown.

Dr. Taylor believes that, where proper attention can be secured, permanent adduction need never occur, and that where this con-

dition has supervened it can be safely and quickly remedied without discomfort and without resort to cutting of bone or soft parts, in all conditions except bony ankylosis. Apparatus shown in Fig. 3.

Dr. S. Ketch, of New York, showed "an efficient traction apparatus for hip disease." He said that some years ago Dr. Hutchison, of Brooklyn, called attention to the fact that the traction exerted by the ordinary long hip splint was not constant. Several surgeons had tried to overcome this difficulty. In the act of walking, when the foot was lifted, the traction was maintained, but when the foot rested on the ground the traction was lost, due to the "bagging" of the foot strap. To offset this alternate stretching and relaxation, he had attached two rubber bands at the foot piece, not for the purpose of obtaining elastic tension, which he did not consider necessary, but in order to secure uniform traction. Lack of time prevented a fuller description of this device, which in his own hands had certainly been very beneficial in maintaining constant traction, — a thing certainly to be desired in cases of chronic coxitis, especially in the more acute stages, where traumatism should be reduced to the minimum.

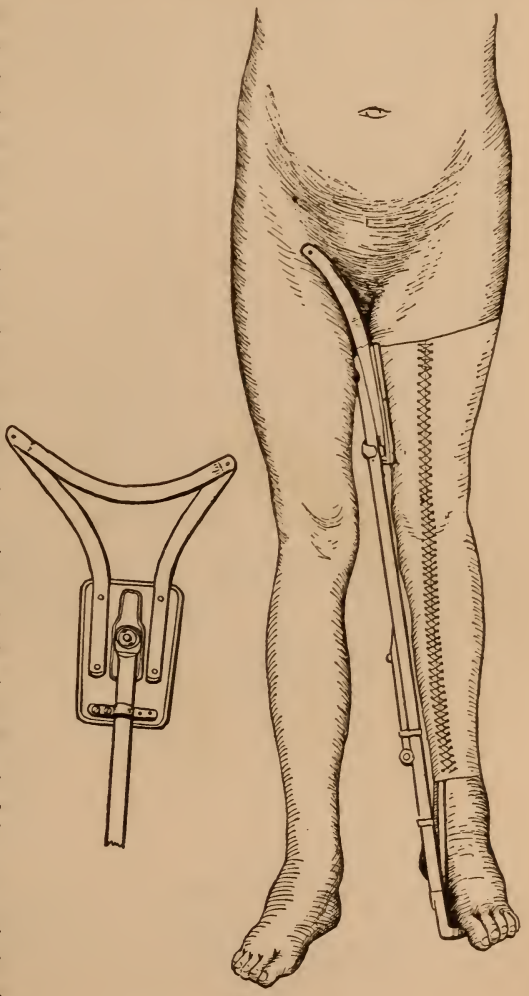

Fig. 3.

A paper by Dr. C. F. Stillman, of New York, "Apparatus for the Correction of Round Shoulders," was read by title. Dr. Stillman said: —

Mr. Chairman: Owing to the shortness of time still left to the Association before the hour of adjournment, I herewith offer my paper on "Round Shoulders" to be read by title; and instead of taking up the time of the Society, which can be utilized to better advantage by others who are still to follow me, by reading this paper at the present time, I will place it in the hands of the Publication Committee, with your consent, for publication in the Transactions, and will exhibit to you several new forms of apparatus which are founded upon what I believe to be one of the greatest principles in modern orthopedic surgery, — the V-spring lever.

The first one I will show you — and the patient is here before you — illustrates its effect upon simple antero-posterior curvature, or round shoulders. You will notice that there is a long bar and a short bar operating in different directions, the long bars tending to maintain the body in an erect position, while the short bars press out the deformity, thus exercising a constant active spring force, which not only tends to maintain the patient in a proper position but causes the deformity itself to disappear. You will notice that a head-piece can be attached to this, which, when the curvature is very high up, obviates the dropping forward of the head and neck.

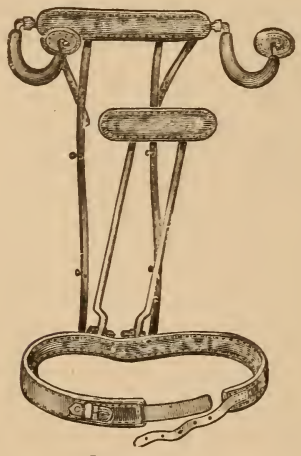

Fig. 4.

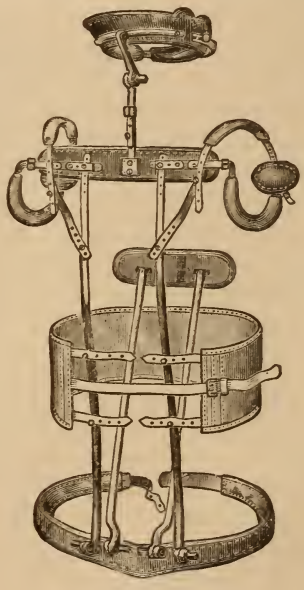

Fig. 5.

The next brace I will show you is the application of the same principle to caries of the spine; the long bars of the instrument tend to hold the spine completely at rest, while the short bars, which terminate in pads opposite the seat of the disease, tend to press out the kyphos and to maintain a constant elastic force, which causes the most complete fixation of the diseased portion with a minimum of discomfort. You will see several of these: the first showing it applied to the dorsal region in its upper portion; the second, to the lower dorsal region; the third, to the lower lumbar region; and the fourth, to the cervical.

In the knee brace which I show you, the same principle is applied to overcome the tendency to backward luxation of the tibia upon the femur. In bowed legs, the effect is not only to keep a constant pressure exactly opposite to the deformity by the short bar, but the long bar supports the limb, preventing lateral motion at the knee, and the foot portion of the brace can be so regulated as to overcome either inversion or eversion by means of ratchets placed below the ankle.

I will not further take up the time at this meeting with the further exhibits of my appliances founded upon this principle, but will reserve them for future occasions.

Dr. Dillon Brown presented some photographs in illustration of the results of osteoclasis in cases of bow-legs. He also presented one of these patients who had a marked anterior curve, — a deformity in which some surgeons believed that osteoclasis was not applicable. There were fifteen cases, and in only one had there been any return of the deformity, although the limb was only put up in plaster for six weeks after the operation, and the patient then allowed to go without further treatment.

Dr. G. S. Knickerbocker, of New York, exhibited a drawing of a device for relieving adduction in hip disease without sending the patient to bed, provided the joint is not very sensitive.

The apparatus is intended to be used in connection with the Taylor hip splint, and consists of two straps, both buckled to the front of the pelvic band on the side of the diseased joint, which straps pass over the shoulders, then down the back, and are buckled to the posterior portion of the pelvic band, also on the affected side. A third strap, to which the shoulder straps are sewed, passes around the body just below the axillæ; this serves to prevent the shoulder straps from slipping. The perineal strap on the side of the disease is buckled loosely or left off altogether.

The action of this apparatus is as follows: The perineal strap on the well side holds down the portion of the pelvic band to which it is attached, and furnishes the fixed point; the straps passing over the shoulders represent the power, and lift upwards the pelvic band on the affected side. This action necessarily abducts the perpendicular bar of the splint, and along with it the leg is abducted.

The advantages claimed for this are: (1) that it can be used as soon as a tendency to adduction shows itself, and thus the necessity of treatment which requires confinement to the bed is avoided; and (2) that it is particularly useful in those cases where adduction recurs again and again after the deformity has been relieved by the usual treatment.

The Association then went into executive session, and elected the following officers for the ensuing year: —

President	Newton M. Shaffer, M.D., New York.
Vice-Presidents	E. H. Bradford, M.D., Boston. A. Sidney Roberts, M.D., Philadelphia.
Secretary and Treasurer	Lewis Hall Sayre, M.D., New York.
Corresponding Secretary	S. Ketch, M.D., New York.
Committee on Publication	H. L. Taylor, M.D., New York. R. W. Lovett, M.D., Boston. L. H. Sayre, M D. (*ex officio*), New York.

The following resolution was presented and adopted: —

"*Resolved*, That the President and Secretary of the American Orthopedic Association be authorized to change, if they deem it best, the time of meeting in 1888."

The Association then adjourned, subject to the call of the Executive Committee.

SECOND ANNUAL MEETING.

HELD AT WASHINGTON, D. C., SEPTEMBER 18, 19, AND 20, 1888.

September 18, First Day, Morning Session.

The Association met at Welcker's Hotel, and was called to order by the President, Dr. Newton M. Shaffer, of New York, at 10 A. M., who made a few remarks on the growth of orthopedic surgery and the merited distinction it has attained as a specialty of late years.

The Secretary, Dr. Lewis Hall Sayre, of New York, then read the minutes of the meeting for permanent organization, which were approved.

Dr. A. B. Judson, of New York, read a paper on "A Practical Point in the Treatment of Pott's Disease."

Dr. V. P. Gibney, of New York, contributed a paper entitled "Report on the Treatment of Club-foot by means of the Thomas Wrench."

The Association then adjourned.

September 18, Afternoon Session.

The Association reassembled at 3 P. M., and was called to order by the President.

Dr. H. Hodgen, of St. Louis, Mo., contributed a paper entitled "Report on Morton's Operation for the Immediate Reduction of Club-foot," followed by one on "An Analysis of Treatment of Seventy Cases of Club-foot," by Dr. E. H. Bradford, of Boston, Mass.

The two papers were discussed conjointly.

Dr. George W. Ryan, of Cincinnati, read a paper entitled "A Case of Reflex Valgus."

The Association then adjourned.

September 19, Second Day, Morning Session.

The Association was called to order by the President at ten o'clock.

The Secretary read the minutes of the previous sessions, which were approved.

Dr. Royal Whitman, of Boston, read, by invitation, a paper entitled "Observations on Seventy-five Cases of Flat Foot, with Particular Reference to Treatment."

Dr. De Forest Willard, of Philadelphia, read a paper on "Osteotomy for Anterior Tibial Curves." This paper was followed by one entitled "Femoral Osteotomy," by Dr. Ap Morgan Vance, of Louisville.

The discussion on these two papers was postponed until the afternoon session.

September 19, Second Day, Afternoon Session.

The President exhibited an osteoclast made by Colin, of Paris.

Dr. Henry Ling Taylor, of New York, read a paper on "The Mechanical Treatment of Senile Coxitis."

September 20, Third Day, Morning Session.

The Association was called to order by the President at ten o'clock.

The Secretary read the minutes of the second day's proceedings, which were approved.

The first paper was by Dr. Benjamin Lee, of Philadelphia, "On Hæmatoma Oris, as a Sign of Injury to the Spine in the Superior Cervical Region."

Dr. A. J. Steele, of St. Louis, Mo., contributed a paper entitled "Two Knee-Joint Excisions."

Dr. Robert W. Lovett, of Boston, presented a paper on "An Experimental Study of Fixation and Traction in Hip Disease," and presented a splint.

Dr. W. R. Whitehead, of Denver, Col., read a paper entitled "Remarks on the Operative and Mechanical Treatment of some Joint Diseases and Injuries; with Special Reference to the Hip, Knee, and Elbow Joints, with Illustrative Cases."

Discussion on Dr. Whitehead's paper was postponed. The Association then went into executive session.

The PRESIDENT appointed as Auditing Committee Drs. VANCE and RYAN.

Dr. BRADFORD offered the following:

"*Resolved*, That all essays and contributions, the titles of which have been sent and accepted by the Association for use at its annual meetings, shall be the property of the Association, and shall not be withdrawn or used for other purposes without the consent of the Executive Committee."

Dr. WHITEHEAD saw no objection to having the papers published in some medical journal after they had been read before the Association, and prior to their appearance in the Transactions.

Dr. RYAN would amend the resolution by substituting the word "published" for the word "withdrawn," which was finally carried.

The election of officers for 1889 was next proceeded with, resulting as follows:

President	E. H. BRADFORD, M.D., Boston, Mass.
First Vice-President	BENJAMIN LEE, M.D., Philadelphia, Pa.
Second Vice-President	V. P. GIBNEY, M.D., New York.
Secretary and Treasurer	ROBERT W. LOVETT, M.D., Boston.

The Auditing Committee reported having carefully examined the accounts of the Treasurer and found them correct.

On motion of Dr. STEELE, seconded by Dr. MOORE, Boston was selected as the next place of meeting, which after a little debate was carried.

Dr. STEELE proposed the following amendment to the By-Laws: "That the annual meetings of the Association be held on the third Tuesday in September of each year." Carried.

The Association then adjourned till two o'clock.

September 20, Third Day, Afternoon Session.

The Association reassembled at 2 P. M., President SHAFFER in the chair.

The discussion on Dr. WHITEHEAD's paper was proceeded with.

At the close of the discussion, Dr. SAMUEL KETCH read a paper entitled "Remarks on Lateral Curvature and its Early Treatment."

Dr. L. A. Sayre, in opening the discussion, said the period of puberty had nothing whatever to do with producing lateral curvature, but the fact that it is generally discovered about this period had led to the belief that puberty has had something to do as a factor in producing the deformity. A little girl may have been deformed for years, and never have known it until she is old enough to be sent to a fashionable dressmaker, who discovers it in fitting her dress and informs the mother. When these lateral curvatures are discovered, not only in children, but in all cases, proper gymnastic exercises which require study and care, and which he had not time to explain fully, should be recommended and carried out; and thus these deformities in the majority of cases would be corrected without instrumental means of any kind. He would not advocate a fixed apparatus nor a plaster-of-paris jacket or any other machinery in these cases; for such apparatus interfered with the free play of the muscles and was detrimental instead of beneficial, and should only be used in those severe cases of bony deformity where the muscles could not retain the body in proper position without artificial aid.

Dr. Lee. — I think one reason why we as orthopedists so often fail to get these cases in the curative stage is because of the singular disinclination of the family practitioner to be willing to recognize their seriousness at the outset. In my experience, there is not one family practitioner in a hundred, who, when a mother calls his attention to what she fears is trouble in the spine of her child in the shape of not only lateral but often even of posterior curvature, will not exclaim, "Pooh-pooh! that is nothing; the child will outgrow it; all that it wants is fresh air and plenty of exercise." The consequence is that when we get these cases the deformity has progressed so far that we can only make a botch of them. We cannot get results such as would be possible if the cases were brought to us earlier.

In regard to this question of causation of the disease and its relation to puberty. To my mind, no explanation has ever been offered which is at all adequate. The term "scoliosis habitualis," as conveying the idea that the deformity is the result of bad habits in sitting or standing, is altogether misleading, and should be dropped from our nomenclature. If faulty positions in sitting at the desk were the cause, no children ought to escape. Why is it that in nine cases out of ten it occurs in girls rather than in boys? In my own experience rotatory lateral curvature has occurred in a very

large majority of cases in girls, either in childhood or just at puberty; and I have been disposed to think that the lumbar curve is usually the initial curve, although the upper curve is often first detected, — or, to be more exact, that the rotation begins first in the lumbar region. I have supposed that there might be a connection between an irritation in the lumbar plexus and the irritative lesion of the psoas and iliacus muscles, dependent upon a condition reflected from the ovaries during their period of active development. Precisely what that connection is, I do not pretend to say. I merely suggest this as a clew to the enigma, "What is the cause of rotatory lateral curvatures?"

Dr. KETCH. — There are one or two points Dr. Lee spoke about that I would like to call attention to. He alluded to the rarity of lateral curvature in boys. Now, I would say that in the two hundred and twenty-nine cases I have analyzed, forty occurred in boys, and one hundred and eighty-nine in females. It is not, therefore, so rare in boys as is generally supposed.

Concerning the question of puberty in the matter. There are many cases, for instance, of phthisis which remain quite latent until this active physiological period arrives; then suddenly, by reason of a general physiological turgescence, all the symptoms of the conditions become more pronounced, and are brought more immediately to our eyes than formerly.

Dr. R. W. LOVETT then showed some apparatus from the Children's Hospital, Boston; and Dr. JOHN RIDLON exhibited a Thomas Splint as modified for use in infantile paralysis, and a shoe for use with the Thomas Calliper Splint.

The following papers were read by title: Dr. C. F. STILLMAN, of New York, "An Efficient and Inexpensive Method for the Mechanical Treatment of Pott's Disease;" Dr. JOHN RIDLON, of New York, "Double Hip Disease, with a Report of fourteen Consecutive Cases;" Dr. T. G. MORTON, of Philadelphia, "Description of an Apparatus for measuring any Inequality in the Length of the Lower Extremities;" Dr. DILLON BROWN, of New York, "Acute Epiphysitis in Infants;" Dr. A. SYDNEY ROBERTS, of Philadelphia, "The Surgical and Mechanical Treatment of the Deformities of Infantile and Cerebral Paralysis;" Dr. NEWTON M. SHAFFER, of New York, "The Modern Treatment of Chronic Joint and Spinal Disease;" Dr. E. G. BRACKETT, of Boston (by invitation), "Distraction of the Head of the Femur, a Result of Extension;" Dr. C. N. DIXON JONES, of Brooklyn (by invitation), "Etiology and Pathology of Rhachitic Deformities."

The Association then went into executive session.

Dr. Ketch moved that the thanks of the Association be tendered the President for the very able and efficient manner in which he had discharged the duties of his office during the past year, which, on being seconded, was carried by acclamation.

On motion the Association adjourned.

COMMUNICATIONS.

HYPERTROPHY OF ONE LOWER EXTREMITY.

BY G. B. PACKARD, M.D., HARTFORD.

Perhaps the case that I am about to relate does not properly belong to the domain of orthopedic surgery; but as such cases are sure to consult the orthopedic surgeon, it may be of some interest to the Society.

About six years ago a child five years of age was brought to my office with an enlarged lower extremity, as hereafter described. W. M., the father, aged sixty-one, is a strong healthy man; but phthisis has occurred in several of his near relatives, including father and grandfather. The mother, aged forty-eight, has phthisis at the present time and also inherits it. Has had three children, — the remaining two not being very strong. There is no evidence of syphilis in either of the parents or child. The child has had none of the diseases incident to childhood except whooping-cough, and with the exception of the anomalous condition to be described has been a healthy boy. He seemed backward about walking and standing, but at the age of three could walk well, — in fact, nothing unusual was noticed by the family, except, as the mother expressed it, "one foot seemed softer than the other." The difference in size of the sound and the diseased leg at the first visit was very apparent by inspection, but the exact sizes I have forgotten. The diseased leg was three quarters of an inch longer than the sound one. The hypertrophy or enlargement seemed to involve all of the tissues of the limb, including the bone and extending through the foot, leg, thigh, and to a slight extent upon one side of the body.

The power of the limb was not commensurate with the increase of development, neither was it any weaker. Motion was natural in all the joints. The skin, though perhaps thicker than normal, seemed quite natural. There seemed to be no œdematous or indurated condition of the tissues. Does not pit upon pressure; slight enlargement of inguinal glands. The mother being very anxious to have something done for the child and desirous of placing him under my care, I applied a rubber bandage and continued its use for several months. Under this pressure the limb did not gain on its fellow of the opposite side, but I thought diminished a little. However, the result after a year's time did not show much improvement, and the most troublesome symptom of all — the increase in length — had continued to progress; so from that time on, I did very little in way of treatment except to advise high shoe for the sound leg. I saw the patient occasionally for the succeeding three years, and during this time the limb continued to develop in every way faster than the sound one. From this time up to a month ago I had seen very little of the child. But at this visit I found the limb had continued to gain on the sound one, and now measured three inches more in length, also in other respects the hypertrophy was well marked, and now the measurements are as follows: Sound limb, at thigh, 12 inches; at calf, 9 inches. Diseased limb, at thigh, 14 inches; at calf, 10½ inches.

At this time I found some spots that felt like little cysts under the skin, but rather deep; also increase in the size of inguinal glands. There is not at present, nor has there been at any time, any inflammatory condition of the skin, nor anything like the conditions of the skin that are seen in elephantiasis; but all the tissues seem alike involved, — the osseous, cellular, and adipose, as well as the cutaneous. About this time the case was seen by Dr. Gibney, of New York, and examined very carefully. He considered it, as I had previously called it, a case of congenital occlusion and dilatation of the lymph channels, and advised in the near future to have the limb amputated, as locomotion was getting more and more difficult. The father being anxious to have the operation done at once if it must be done at all, it was decided to take the limb off without further delay,

and three weeks ago I amputated the leg below the knee, taking off fourteen inches. Patient has done very well, and stump nearly healed. I found hypertrophy of the adipose, cellular, cutaneous, and osseous tissues. The muscular tissue was about natural, certainly not enlarged to any extent. The venous and arterial vessels were normal, but the lymphatic vessels were enlarged to three or four times their natural size, and seemed to be large tortuous cords with an occasional cystic enlargement. In Vol. X. of the "Journal of Obstetrics" have appeared a series of articles on the subject of occlusion and dilatation of the lymph channels by Dr. Busey, of Washington, in which he has grouped a large number and variety of cases of congenital elephantiatic developments and such other congenital cases as primarily exhibit abnormal conditions of the lymphatic vessels. In one case that he mentions he says that after a long while the skin thinned in different places, forming small shining spots slightly elevated, which ruptured spontaneously and discharged a yellowish-white tenacious fluid which upon exposure to air coagulated into a jelly-like mass. This discharge occurred three or five times during the year, and continued for thirteen years. The autopsy showed in this case, where the hypertrophy existed, dilated lymph vessels, and the most superficial vessels could be traced into the cysts projecting from the skin.

The growth of the limb in many cases is easily accounted for, as he remarks, by the retention of lymph in the parts affected, which is regarded as a nutritive fluid. The cause of this obstruction is certainly a very interesting question, and it is quite likely due to the presence of a parasite in the lymphatic vessels, as recent observations have shown that the obstruction in elephantiasis is due to the presence of the parasite filaria and its ova. The points of interest in my case are the increase in length of bone and the comparatively healthy condition of the skin, — being two marked symptoms in separating it from the true cases of elephantiasis. Of course the future progress of this case may show entirely new points of interest, and I shall watch it with a great deal of care.

Discussion.

Dr. H. L. Taylor, of New York. — Mr. President: This case related by Dr. Packard reminds me of one which I saw over three years ago, and which I did not at that time understand. The patient was a Swedish girl, twenty-one years of age, who when she first came to me had the right leg enormously enlarged from the knee down to the ankle. The leg measured seventeen and a quarter inches around where the calf ought to be, while the sound limb measured only thirteen and a half inches. The thigh was larger than it should be, as was also the whole right side of the body. The right leg was an inch and a quarter longer than the left. The principal change had taken place between the knee and ankle; in this region the skin was tense, and pitted on pressure, but was not hypertrophied. The patient said the condition had lasted about three years. I saw her from time to time for two years, and advised a high shoe to make up a part of the difference in length between the two limbs. This afforded her considerable relief. During those two years the swelling remained about the same, until, during an attack of pneumonia in the spring of 1885, it became very much less, and in September, 1885, the right calf measured fourteen and three quarters inches. The general health remained unimpaired, except for some anæmia. There was no lateral curvature. I did not know what diagnosis to make, and sent her to Dr. Bull, who also confessed ignorance of the nature of the trouble. It seems to me that it may belong to the same class of cases as Dr. Packard's.

Dr. Morton, of Philadelphia. — Mr. President: I have seen a case somewhat similar to that described by Dr. Packard, with the exception that there was not so much increase in the length of the limb. In this case I thoroughly stretched the sciatic nerve, thinking it would be well to attack the nutrition of the limb, which subsequently diminished very much as the result of the operation.

The experience which led me to operate in this manner occurred in a case of elephantiasis, in which I excised an inch of the sciatic nerve.[1] Paralysis followed. The calf diminished from twenty-four inches to twelve inches; the whole limb lessened proportionately. The patient died six months afterwards of an acute lung affection.

[1] This case was fully reported in "Surgery of the Pennsylvania Hospital." Philadelphia, 1880.

Remarks on Instruments for the Forcible Correction of Club-foot.

T. G. Morton, M.D. — Mr. President: I have here two instruments for foot-stretching, which I will make the basis of some remarks on the treatment of club-foot.

There are few, if any, cases of congenital club-foot which, if seen sufficiently early, cannot be entirely corrected by manipulation, aided subsequently, perhaps, by the use of an apparatus. At any rate, most of the cases of varus and equino-varus in infants which have come under my observation recover without operative treatment; at most requiring section of the tendo achillis when the child is able to walk, and in the case of varus no difficulty need be experienced in its treatment without operation. But in cases of robust children and those of more advanced years, we may be obliged to resort to tenotomy and stretching or excision of the cuboid to overcome the deformity.

I here present an apparatus which I have used in young subjects for a number of years (see Fig. 6). It consists of a block of wood, on which is fastened an inverted and well-padded horse-shoe, into which the heel of the foot is held by an assistant or is secured by a strap passed over the instep; a pad draws strongly upon the projecting tarsus by means of a powerful screw; another band and screw is connected with the forward part of the foot, and makes traction in the opposite direction. Any amount of force is thus brought to bear upon the deformity; flexion and rotation can readily be made. In using this we are able to accomplish in a very short period much more than by simple manipulation.

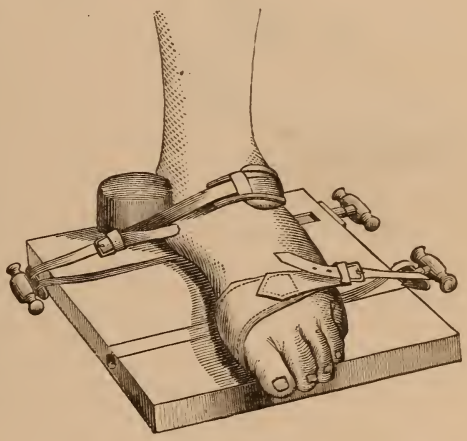

Fig. 6.

When it comes to the adult club-foot, my experience has been that the tarsus is so very dense, unyielding, and altered in shape, that generally it is simply impossible to bring it into position, without resorting to fracture, or excision of the tarsus, or both.

Since the introduction of more perfect methods of antisepsis, the latter operation can now be done with entire freedom from danger; and for forcible and immediate rectification of the deformity, I show you here another instrument, very much more powerful however, by the aid of which (see Figs. 7, 8), with the patient under the

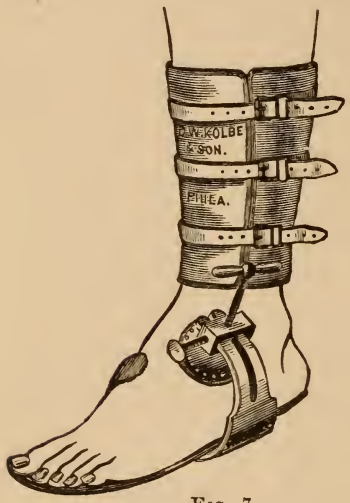

Fig. 7.

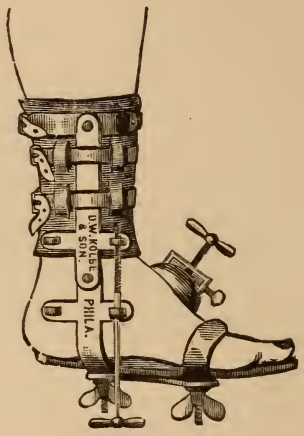

Fig. 8.

influence of ether, we can readily overcome, with free tenotomy and division of all unyielding tissues, any tarsal deformity. I have frequently had occasion to use this apparatus, and have never seen the slightest ill results follow. This instrument also enables the surgeon to bring the foot into a right or acute angle, and to overcome not only a varus but an equinus. Of late, in some very severe cases of varus and equino-varus, I have performed excision in preference to forcible stretching, thus securing immediately excellent results.

In one of the worst cases of double equino-varus which I have ever seen, the patient walking upon the dorsum of the foot, I excised the cuboid (under strict antisepsis); the wounds healed by first intention. (Photographs were presented.) In another case lately of adult equino-varus, I used the chisel in excising a wedge from the tarsus including the cuboid with perfect success.

In the case of the double operation for excision of the cuboid in the case of equino-varus already alluded to, the patient, a well-grown lad, was able to walk fairly well a month after the operation.

Dr. RIDLON inquired of Dr. Morton whether he found his instrument alone sufficient in cases of club-foot in which there was an actual rotation inward at the angle, due to shortening and increased strength of the internal lateral ligament.

Dr. MORTON. — I would use this instrument in every instance when I found that I could not correct the deformity by tenotomy and the ordinary means, and when excision of the cuboid or tarsus was not permissible.

I wish it understood that I would only use the more powerful of these instruments in the deformities of adults. The deformities of children yield to hand-stretching, or the application of the less powerful instrument, with tenotomy and appropriate apparatus.

The smaller instruments can be used with advantage in any case, and almost at any age, when it is desirable to employ a greater amount of stretching than can readily be done by the hand. The larger instrument is intended for the dense, unyielding, and often excessive deformities seen in adults. There are such cases, where it is impossible to obtain any benefit without resorting to immediate forcible rectification with tenotomy or excision, or both combined.

Dr. L. H. SAYRE. — Mr. President: I agree with Dr. Morton as to the necessity of cutting all restrictive bands and ligamentous structures which interfere with putting the foot into a correct position; and if correction was still impossible I should certainly approve of putting on a shield of this kind and breaking the foot into position; but I would ask him what is his after-dressing? I suppose he retains the foot in position for a time afterward.

Dr. MORTON. — Immediately afterward I put the foot into a tin splint, elevate it, and do not disturb it. No abscess or cellulitis has followed. The foot, you know, is wonderfully subservient to the surgeon.

Talipes equinus treated successfully by Division of the Tendo achillis after having resisted Mechanical Treatment.

Dr. L. H. SAYRE, of New York. — Mr. President: I present this boy to show the results of tenotomy after unsuccessful attempt to stretch the tendo achillis by traction apparatus. Four years ago I saw this boy for the first time. He had had an attack of infantile paralysis. The foot could then be brought into position without the use of force. It was simply want of power in the

anterior group of muscles of the leg that caused extension of the foot. I saw him again two years later. In the mean time he had been treated by instruments, I believe by galvanism and massage, and by hypodermic injections of strychnine without effect. Two years ago I found the tendo achillis so contractured that the foot could not be brought to a right angle with the leg; when the attempt was made it produced reflex spasm in the tendo achillis and plantar fascia. I advised division of the plantar fascia and tendo achillis, but it was not consented to. About three weeks ago I saw the patient again. In the mean time for about seven months an attempt had been made to stretch the tendo achillis by a traction apparatus. Two weeks ago I divided the plantar fascia and tendo achillis, and replaced the foot in the normal position. I was obliged to re-dress the foot the next day because of a blister on the big toe. Since then I have not touched it. To-day we find the tendo achillis reunited, the foot is at right angle, and can be brought down with some power.

Dr. Ketch, of New York. — Mr. President: While acknowledging the very good results here of section of the tendo achillis, I would like to make some remarks about mechanical treatment as it was tried in this case. I saw this boy about a year ago, just previous to his departure for the country, and diagnosticated his condition as equino-valgus due to infantile paralysis. The parents having previously refused tenotomy, I told them I thought the foot could be restored to a good position by mechanical treatment, with tenotomy as a further measure should it prove necessary. I applied one of Dr. Shaffer's so-called extension or traction shoes. I saw the boy personally two or three times, twice before he went to the country, and instructed the parents concerning the use of the apparatus. With due respect to the efforts of the parents in the use of the instrument, I do not consider this case a good example of treatment by traction. In the treatment of these cases by the traction method, I have not found personally that I could trust the management of the case entirely to the parents.

As I remember this case there was not an excessive contraction of the tendo achillis; I believe not quite half an inch. I think the case illustrates very well a point which, according to my personal experience, is not uncommon; namely, failure of mechanical treatment when left in the hands of those who are not accustomed to its use. I am quite confident that if I had seen this boy regularly the heel could have been brought down without the perform-

ance of tenotomy. In conclusion I wish to enter a protest against this case as a failure of the mechanical treatment of club-foot.

Dr. Ridlon, of New York, asked Dr. Sayre whether he was satisfied after doing tenotomy for equino-varus to bring the foot only at a right angle, as appeared to be the amount of correction in this case and another which he had published in the "New England Monthly." Those who employed the traction apparatus sought to bring the foot in the direction of flexion as far beyond a right angle as possible.

Dr. Sayre replied that in this case he was very well satisfied with the result as far as it had gone. But he did not consider a case of equinus as cured when the foot could be brought only to a right angle; it should be able to be flexed beyond this point, or it would be only a question of degree of improvement over the previous condition. In this case there should be after-treatment to see that the foot did not go back, and if possible to get greater flexion.

Dr. H. L. Taylor. — Mr. President: This is a point which has been brought up from time to time in our societies. It is a very interesting one, and one upon which we hold radically divergent views. Would it not be in accordance with the purposes of this Association to appoint a committee to investigate this subject, taking patients, for instance, who exhibit the point-pressure phenomena and whose condition, as asserted by Dr. Sayre or other surgeons holding similar views, demands tenotomy, and treating them by traction, if in the opinion of Dr. Shaffer, or others entertaining like views on this question, traction is sufficient to cure the deformity?

Dr. A. S. Roberts, of Philadelphia. — Mr. President: The discussion has been directed to the tendo achillis, while little has been said about the plantar fascia. During the last four months I had three cases of marked contraction of the plantar fascia, and after only partial success from extension applied by intelligent attendants, I divided the fascia. In each one of these cases there has been positive relapse after apparent cure. Three to six weeks after the operation, and before the relapse, the cure was considered as effectual as in this case of Dr. Sayre's. So I would ask whether the result obtained by Dr. Sayre ought to be placed upon record as permanent, or whether one should not wait another two or three weeks or months. I think a permanent result is to be obtained by extension rather than by division of fascia.

Dr. Stillman, of New York. — Mr. Chairman: I should like to say a word in reference to the preparatory treatment of club-foot previous to the operation. It is my custom for a week or two before using the tenotome to keep the foot and the lower portion of the limb poulticed with a large thick mixture composed of equal parts of bran and marsh-mallow leaves. This procedure causes all the tissues of the extremity to become pliable, and enables the surgeon to obtain more prompt results from the operation as well as rendering the after-treatment less prolonged.

The treatment of club-foot may be divided into three stages: first, the preparatory, of which I have just spoken; second, the operative, which may be, but is not always, necessary; third, the after-treatment. At one time I held and published the view that every case of club-foot could be cured by mechanical means; but at the present time I am inclined to the opinion that some cases exist which cannot be cured by any means of mechanical stretching, and for these I would first encase the foot and ankle in a poultice and put the patient to bed for one or two weeks, thus insuring perfect rest for the part for that length of time.

The after-treatment is perhaps the most important of all, for upon it depends not only the permanent correction of the deformity but the prevention of relapse. The preparatory treatment is comparatively simple, as is also the operative; but the after-treatment is very important, as upon it depends the completeness of the cure. For the after-treatment it is always necessary to use some form of brace which will tend to keep the foot in as nearly a normal position as possible. There are a large number of appliances which have been devised for this purpose, but it is important to select one which will retain the foot in such a position that the weight of the body, when the patient walks, will be a factor in decreasing instead of increasing the amount of deformity.

Dr. Morton, of Philadelphia. — Mr. President: It seems to me the question of the result after operative treatment in club-foot depends very much upon the condition of the limb. Except in acquired club-foot from injury or disease, such a change in the limb is the result of a nerve involvement.

If there is more or less paralysis of the anterior group of muscles and a stronger posterior group, there will be club-foot, simply because the anterior muscles manifest less reactive power. In the case presented by Dr. Sayre, I do not believe the affected limb will ever become as well developed as the other; but it will grow more or

less in proportion to the growth of the sound limb, but the boy, when he shall have attained to the age of eighteen, will probably have one limb an inch or more shorter than the other.

Dr. Stillman. — Mr. Chairman: One other remark relating to what Dr. Morton has just said regarding the after-treatment of club-foot. It is advisable, after tenotomy, to so twist the foot as to place it in a position almost diametrically the opposite of the original deformity, thus, as nearly as possible, converting a valgus into a varus or a varus into a valgus; and it is a point of practical importance to build up the sole and heel of the shoe on the opposite side, thus tending to throw the foot in an opposite direction to the existing deformity.

Dr. Ketch. — Mr. President: We have rather deviated from the case presented, and entered upon a general discussion of the treatment of club-foot. But there is still one interesting fact in this case to which I would call attention. It is the condition of the foot supposed to be sound. The calf is magnificently developed; there seems to be no fault in the limb at all, yet I remember on examining the foot that there was well-marked contraction of the plantar fascia and a certain abnormal mobility in the joint. This band of plantar fascia causes, on pressure, a decided tremor. What we see here approaches very closely to the non-deforming club-foot which we see so frequently on the so-called sound side following infantile paralysis.

Dr. Ridlon, of New York. — Mr. President: In connection with the cases just related I will refer to one of ostitis of the shoulder in a girl seen at the department for the outdoor poor at Bellevue Hospital. The girl had ankle disease, and was treated eighteen months or two years by a long splint, etc. Two abscesses formed. When she had about recovered from the disease at the ankle joint, disease appeared at the right shoulder joint. There was no abscess, but the arm became atrophied, and was held perfectly rigid against the chest. I was under the belief that hereditary syphilis had something to do with the condition, and had the joint rubbed with blue ointment every day. The arm was not constantly held in the position directed, but after eight months there was considerable motion without pain. I am perfectly convinced that in some of these cases of shoulder-joint disease recovery will take place under the thorough use of mercury.

A CASE OF POTT'S DISEASE WITH AN UNUSUAL DEFORMITY.

BY HENRY L. TAYLOR, M.D., NEW YORK.

THE case whose history I will briefly relate, is that of an unmarried lady, twenty-nine years of age, whom I first saw April 27, 1887.

The peculiarity of the case consists principally in the nature of the deformity, which has been mainly lateral from the start. The patient is an only child, and was always delicate; a cervical gland suppurated when she was a child. There is phthisis on the paternal side of the family. Father and mother are both living.

In the summer of 1882 the patient began to have pains in the sacrum, without known cause; this was diagnosed to be neuralgia by the family physician. In the fall of 1882 the mother noticed that the right hip was higher than the left; this was very marked at that time. The pain grew worse and would come on suddenly, often at night or after making a misstep. Patient held head and shoulders stiff, and stiffened the body in stooping, and leaned upon tables and chairs for support. The pain became very severe and shot across the back of both hips, and finally the patient was advised to go to bed; and indeed she was obliged to do so. She remained in bed from October, 1882, to February, 1883, when the pain had disappeared, and the doctor told her the back was straight, though the patient and her mother think it was still bent somewhat to the right.

From that time to this, over four years, the patient has been gradually growing worse. She would try to keep up until the pain got too bad and then she would go to bed, where she would be more comfortable and the spine, which got bent over to the right while she was up, would usually straighten somewhat. Three or four times she went to bed for several months.

A small knuckle in the lumbar region was noticed early, and one in the lower dorsal region a year later.

Pain continued to be a prominent symptom, and would frequently shoot down the legs; at times she had a severe pain in the left side. Her physician said in 1885 that the patient was suffering from phthisis and sent her to Florida, where she has been until coming to New York last April. The patient did not gain in Florida, and in August, 1886, a swelling appeared in left lumbar region, which increased up to the size of a cocoanut. This was incised Jan. 13, 1887. Patient was very much run down before this, and suffering from symptoms of chronic septic poisoning; pulse was from one hundred and twenty to one hundred and sixty; there was fever and cough and dyspnœa; since then she has been slowly improving; has been dressed and sat up each day since February 1, and there has been no cough since last of February.

Patient examined April 27, 1887. She has a yellowish complexion and looks cachectic. Can walk a few steps very much bent over to the right and with difficulty, by taking some one's arm. Pulse about one hundred and twenty, not feverish. Breath foul; tongue fairly clean; bowels usually constipated. No signs of lung or heart trouble. Urine offensive and cloudy and passed frequently, but contains no albumen. Patient suffers a good deal of pain; not so much the last few days.

She was not able to lie flat on her face, and it hurt her very much to move; there was right psoas contraction and a sinus in left lumbar region, discharging about a dessert-spoonful a day of thin laudable pus. There were two small knuckles in the spine, one at the eleventh dorsal and one at the third and fourth lumbar vertebræ. Both of these projections were very slight for disease of such long duration. At both of these foci of disease there was a sharp bend of the spine to the right, so that the spine as a whole made an angle of about 70° with the pelvis instead of 90°. There was asymmetry, but little true rotation; and there was an attempt at compensation by a gradual bending convexity to the right, in the upper part of the spine. The measurement from the crest of the ilium to the axilla was eleven inches on the right side and thirteen on the left.

A lateral tilt, owing to more extensive excavation of the bodies of the vertebra on one side, is not a rare symptom in

Pott's disease. It is usually not excessive, and commonly disappears quickly if the antero-posterior support be efficient; but this deformity was so extensive and the several features of the case so difficult and unusual that I was at first undecided what form of mechanical support would best protect the spinal column. I decided to use the improved form of Dr. Taylor's antero-posterior leverage supporting and protecting spinal apparatus, curving the vertical bars of the instrument to the right to coincide with the axis of the spinal column, and fitting the hard rubber pad-plates which extended from the mid-dorsal region to the sacrum, accurately to the back. It was a pretty crooked instrument after I had finished. I added perineal straps passing from the hip-plates of the instrument behind to the apron in front. The main action was antero-posterior, but I was able by tightening the left perineal strap to get a lateral pull on the spine to the left. The patient was kept strictly recumbent, and was given cod liver oil and quinine. The improvement of the patient's health has been rapid and continuous. Pain was relieved within a few days after the apparatus was applied, and the patient began to improve in appearance and to put on flesh, but the most remarkable change was in the deformity. The diagram made from actual patterns taken at the time show both the antero-posterior (1) and lateral (2) deformity on May 2, 1887, before the apparatus was applied, and on June 6, 1887, after wearing the apparatus a month.

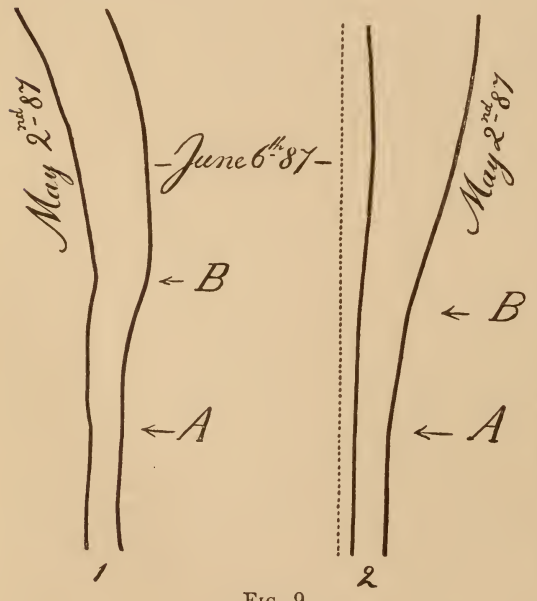

FIG. 9.

The lower lateral bend at B disappeared almost entirely within three weeks. By June 6 the spine had straightened so much that I applied an instrument with back bars and hard rubber pads perfectly straight laterally, which she is now wearing. The abscess is still discharging, and the pulse usually about one hundred and twenty, and the patient is kept in bed.

The interesting points in the above case are the extreme lateral distortion at two points and its prompt rectification by antero-posterior support, coincident with improvement in the general condition.

[July 14, 1887. In the time which has elapsed since reading the above paper the patient's progress has been rapid and satisfactory. She is now allowed to sit up a few moments each day, and her general condition is good.]

Discussion.

Dr. Ridlon, of New York, referred to a case of Pott's disease of the spine, in which lateral deformity was so great that the hip band of the antero-posterior splint ordinarily used at the Orthopedic Dispensary had to be carried up, on one side, to an angle of about 75° with the uprights. After four or five months' treatment, there having been no gain in position, and it being impossible to keep the boy off his feet, a plaster-of-paris dressing was put on over the antero-posterior steel support, the patient being extended on a hammock during its application. By this combined support the boy was able comfortably to go to school, and after eight months the lateral deviation was entirely overcome.

Dr. Ketch, of New York. — Mr. President: Dr. Taylor, in his remarks, has very truly said that a lateral deviation in Pott's disease is by no means unusual. According to my experience I have rather thought that it was in the very early stages of Pott's disease something which we might always look for. Most of the cases of Pott's disease which have applied early for treatment have, according to my observation, showed a certain amount of lateral deviation. This is particularly true in disease of the lower dorsal or lumbar region.

In this connection it may be of some interest to relate a case which I saw several years ago, that of a girl thirteen or fourteen years of age, who came to me with the most marked lateral devia-

tion of the body I had ever seen. There was a certain amount of lordosis. She was wearing a brace applied by a surgeon for lateral curvature of the spine. Examination, however, showed undoubted signs of Pott's disease. There was rigidity of the spine throughout its entire length; there was psoas contraction, a psoas abscess, and elevation of the temperature, higher in the evening. I tried to explain to the parents the nature of the disease, and get their consent to the application of a plaster-of-paris jacket, fearing that proper support could not be obtained by the antero-posterior apparatus of Dr. Taylor. This was refused, however, on the ground that she had obtained a certain amount of relief from the brace. She left the city, and within a few months I received a letter from the mother, stating that an abscess had appeared, she had developed a severe cough and diarrhœa, and died soon after. No autopsy was made.

Dr. Hodgen, of St. Louis. — Mr. President: I may relate a case illustrating the value of carrying out Dr. Taylor's idea concerning straightening the spine. It was one of Pott's disease in the upper dorsal region, with marked angular curvature, in a child between three and four years of age. I applied a plaster-of-paris jacket for about nine months, but the angle became even more prominent, and the child was very uncomfortable. I then tried an antero-posterior steel brace with chin rest, and within three months there was marked improvement, the deformity had become largely straightened, the shoulders were nearly symmetrical, the irritation was disappearing.

Dr. A. S. Roberts, of Philadelphia, presented a plantar spring for use in flat foot. He spoke of the frequency of spurious valgus or flat foot; the pain and debility resulting from it; and the liability of the deformity to be mistaken for rheumatism, neuralgia, or even tarsal osteitis. He described the bony arches of the foot, and the part the second or supplementary one played in support of the superincumbent body weight, together with the changed relations of these parts in the acts of walking, running, dancing, etc. The relation of vessels, ligaments, and fasciæ as accessory supports were also described at some length; the weak point of the arch was located where the astragalus rested upon the os calcis, and in occupations requiring continued standing and walking, the muscular and ligamentous supports of the arch became overtaxed and did not afford proper assistance to the bony arch, as a result of which permanent extension or flattening of the foot resulted.

In speaking of the morbid anatomy, the author stated that in the

congenital variety the flattening of the arch, which is incomplete at this period of life, is more apparent than real, owing to the associated valgus which is always present in these somewhat rare conditions. The causes of the acquired varieties were stated to be rachitis, infantile spinal paralysis, rheumatism, and tarsal or ankle-joint osteitis. Bow-legs and knock-knee produce flat foot symptomatically. These cases generally occur, the speaker went on to say, in adolescence and in those whose occupation compels them to occupy the standing position for a long time. Their gait is characteristic, heavy, and dragging; the knee is bent, while the feet are placed gingerly on the ground. In speaking of treatment, special attention was given to the so-called inflammatory form; the speaker stating that rest, which is essential, could be best attained by the use of tempered steel springs, so made that the convexity of the spring should be at that point where the arch of the foot is most flattened. A great improvement over the narrow spring which was let into the shank of the shoe, had been suggested by Mr. Arthur Lea, in which the spring was much broader, longer, and in addition to supporting the arch of the foot, prevented internal rotation by the extension upwards of flanges from the main body of the spring. Dr. Roberts stated that he had made use of the tempered steel springs in upwards of forty cases, with the most gratifying results in the relief of pain, disability, etc., finding them more convenient than the older forms of plantar support and ankle braces.

Dr. Ketch, of New York. — Mr. President: I would say that I have used this modified apparatus presented by Dr. Roberts in a number of cases of flat foot. It possesses certain advantages, one of which Dr. Roberts has not mentioned; namely, the ease with which it can be introduced into almost any shoe. I have several patients who change this spring from one shoe to another, and even put it into their slippers. This could not be done with the old spring.

The lateral support given by the spring I think has been of great service to my patients. They express decided comfort in wearing this spring. It can also, I think, be better adapted to the amount of deformity present. The other instrument which I had commonly used consisted merely of a tempered spring adapted to the inner side of the foot, running from the heel to the base of the great toe. You observe that the instrument presented by Dr. Roberts gives support to the whole foot rather than to one particular part. It possesses one disadvantage; namely, the tendency of the seg-

ments of the inner wing to straighten out and split. If that occurs, of course it necessitates a new spring.

Dr. L. H. Sayre, of New York. — Mr. President: Within the last six months I saw a case of spurious valgus in which the arch of the foot could not be raised until after division of the tendo achillis. When the tendon was divided the foot could be placed more readily in nearly its normal position. I think with Dr. Shaffer that in a great many cases of flat foot contraction of the gastrocnemius may be an important factor in its production.

Dr. Ketch, of New York. — Mr. President: It seems to me that where there is equinus that in itself ought to a certain extent to be corrective of the valgus. In other words, if the os calcis is raised from the floor only because of contraction of the gastrocnemius, that that in itself ought to be corrective of the valgus. Therefore I am unable to understand how shortening of the gastrocnemius alone is going to cause flat foot.

In cases of disease of the bones of the ankle joint there is often symptomatic valgus, and contraction of the gastrocnemius is secondary thereto.

Dr. Stillman, of New York, described an apparatus which he had improvised for daily exercise for a patient afflicted with flat foot. His practice was to employ an ordinary rowing-machine, such as is used by athletes, with the exception that the rowing apparatus itself is removed. The feet of the patient being secured in the foot-rests, which are attached to the framework of the machine at an angle, a loop is passed under each instep; and a cord from these passed to pulleys attached to the wall, or a frame behind the patient, who is seated upon the movable car of the apparatus. From twenty to forty pounds' weight is attached to each pulley, so that a constant force is thereby exerted to increase the concavity of the arch. Other loops are now placed under the knees, and attached to cords which pass over pulleys which are fastened *in front* of the patient, and from the extremities of these cords about the same amount of weight depends. The exercise consists in alternate flexion and extension of the limbs, during which the pulling force upon the arch of the foot and forward upon the limb itself is constant, and the effect of the exercise is to efface contraction of the posterior muscles of the limb, to restore the arch of the foot, and to strengthen generally the defective muscles of the entire limb. After a few days of such treatment, he has obtained more marked results than by any other method which he has observed.

He also, in these cases, builds up the arch of the foot inside of the shoe with cork, and he cuts off the heel and sole of the shoe at such an angle as to cause the weight of the body to be thrown mainly on the outer side instead of the inside of the foot in walking or standing; and in severe cases he also uses, in addition, a side strip of metal, properly girthed, extending to just below the knee, and articulated at the ankle, which is bent outward, where it passes under the shoe, at such an angle as to convert the foot almost into a position of talipes varus; since, if the foot be placed in this position and walking be advised, every step that the patient takes will become an agent in permanently aiding the reduction of the deformity.

Dr. A. S. Roberts. — Mr. President: It was not my purpose in showing this spring to-day to open a discussion on the etiology, or even on the symptomatology, of flat foot. I have devoted considerable thought to this subject, and have found considerable difficulty in drawing the line between flat foot and valgus, especially when associated with such conditions as Dr. Shaffer has spoken of. I have used this instrument in conditions he speaks of, and also for the mechanical part of the treatment of infantile palsy, where there is a certain amount of contraction of the posterior group of muscles and rotation inward, and it has supported the foot perfectly.

I recollect reading in the "Lancet" some months ago an article in which these cases, if I mistake not, were attributed to contraction of the posterior group of muscles, and advised letting the heel down so that the patient could walk practically on the sole of the foot, throwing as much strain as possible upon the tendo achillis. I can only say that in my experience, which has been considerable, there has not yet appeared a case of club-foot in which there was marked shortening of the tendo achillis. Nor have I seen flat foot result from the artificial shortening of the gastrocnemius, or the raising of the heel by the barbarous fashion of wearing high heels.

The President. — Some writer in the "Lancet" last year advocated raising the heel for the cure of flat foot, and claimed that ballet-dancers who had shortening of the gastrocnemius had anything else than flat foot. He advised flat-foot people to practise the exercises of ballet-dancers. The article was in direct opposition to most that has been said at this discussion. As a matter of fact I have had one or two of my young lady patients study the ballet. I have not had to use the spring in their cases.

CASE OF FUNCTIONAL TORTICOLLIS FROM DEFECTIVE EYESIGHT.

By E. H. BRADFORD, M.D., BOSTON.

C. F., a Swede, twelve years of age, under the care of Dr. Farlow, of Boston, is said by his father to have habitually held his head peculiarly since infancy. As he grew somewhat older he dropped his right shoulder. Since then his attitude in walking, in sitting, and standing has been constantly with his head upon one side and his right shoulder lower than the left. This attitude is so peculiar and noticeable as to offer a serious drawback in any future career, the deformity being disfiguring and noticeable even at a distance. Several means have been attempted for the correction of the deformity in Sweden, — chiefly gymnastics carried out with care for a long period. No benefit followed treatment; and an operation, if necessary, was desired by the father, or the use of a proper appliance.

Fig. 10.

The patient presented very much the appearance of ordinary torticollis; but there was no deviation of the nose usually seen in long-standing wry neck. On careful examination it was found that the head could be placed in a perfectly normal position and held so by the patient for some time, but the distortion returned habitually after a few minutes. No contraction of the muscles was to be felt on palpation: there was no evidence of paralysis, all the muscles being well developed and all movements of the head being made freely and normally.

The back presented a marked lateral deviation with slight rotation. The curvature was, however, not a fixed one, disappearing on recumbency. The muscles of the back were well

developed, and the boy could be placed in a perfectly correct attitude, although such a position could not be voluntarily assumed by the patient. The patient's hearing was normal in both ears, and he could see equally well with either eye. A slight irregularity in the line of the eyes was noticed at times, and for the sake of thoroughness the boy was referred to Dr. Wadsworth for examination of his eyes, who was kind enough to send the accompanying report: —

"When the head is held approximately in the normal position, the left eye stands one ″′ higher than the right. There is no paralysis; the excursion of either eye is normal in all directions. The boy is never troubled by double images. When the head is tipped to the right, inclined forward, and turned somewhat to the right, and at the same time the eyes are directed downward and to the left of the median plane of the head, the eyes fix binocularly. But even in this position, as soon as the left eye is covered it rolls upward about one ″′. When in this position the right eye is covered, it does not move downward. In no other position do the eyes fix binocularly.

"In the stereoscope (F before right eye, L before left) both images can be seen at once, and by a vertical prism of 18° can be brought to the same level; but attempts to unite the images to form an E, even with the help of lateral prisms, fail.

"Each eye is quite normal in appearance, aside from the faulty position, externally and on ophthalmoscopic examinations. Vision of each, $1\frac{1}{2}+$, and refraction, with homatropine, hypermetropic 0.75 D."

In brief, to obtain binocular vision the boy is obliged to hold his head on one side. As he unconsciously has always sought for binocular vision, he has habitually held his head sideways, and this has become his natural attitude. Manifestly any treatment would be futile unless directed to the correction of the eyes, and he was referred to Dr. Wadsworth for treatment.[1]

The case is worthy of record among orthopedic surgeons for diagnostic purposes.

[1] A report of the result of treatment, which will be necessarily prolonged, will be made by Dr. Wadsworth to the Ophthalmological Association.

LUMBAR AND PSOAS ABSCESSES TREATED BY INCISION AND DRAINAGE.

By E. H. BRADFORD, M.D., BOSTON.

Lumbar and iliac abscesses constitute a most formidable complication in caries of the spine, even more so perhaps than psoas abscesses, as the possibilities of dangerous rupture are greater, and the future course more uncertain. They present a mass of tuberculous matter, which either remains permanently in the body, a source of possible future tuberculous infection, or they extend, bursting internally or through the skin; in the latter way often exposing to the danger of septic absorption through the imperfect drainage of a large cavity.

The frequency of pelvic abscess is shown in Michel's figures, — out of forty-eight cases he found thirty-nine in the pelvis (Nouveau Dict. de Med. et Clin.), and Parker (Brit. Med. J., Jan. 12, 1884, p. 78), in an examination of eighty-two dorsal cases, twenty-one dorso-lumbar, thirty-seven lumbo-sacral caries of the spine, found that there were abscesses in eight per cent of the dorsal cases, thirty per cent of the dorso-lumbar, and in seventy per cent of the lumbo-sacral. (Vide also Lachanière, Boston Med. and Surg. J., April 24, 1884, p. 397.) This may fairly illustrate the fact that the problem of the treatment of iliac abscess is one frequently presented to us.

Exactly in what way the question should be met is well worthy of discussion, as authorities range from the standpoint of extreme expectation and conservatism to that of early and radical operation.

Treatment of the spinal column, fixation, relief of intervertebral pressure will always be regarded as an essential, and in many cases will be sufficient to promote the absorption and disappearance of the abscess. Whether this takes place will depend in all probability on the amount of injury that has been done to

the vertebræ before treatment was begun, the extent of the lesion of the bone, the size and contents of the abscess, whether chiefly caseous or containing bony sequestra, or whether the proportion of serous fluid is large. Even if absorption does not immediately take place, the mass may become encapsulated and be apparently of little account except as a threat. But frequently, as is well known, such abscesses extend, burst, and give rise to much trouble.

Expectation offers a thoroughly recognized method of treatment, well sanctioned by authority, and backed by excellent results in many cases.

One of the most noticeable of these was presented by a young gentleman of twenty, who had been a patient of Dr. C. F. Taylor, of New York. His Pott's disease began when he was a young child of three, and for a number of years he was under constant treatment.

At the time that I had an opportunity to examine him he was twenty years of age, and had for several years been free from any symptoms of his disease and was apparently entirely well. He had been without a support for the spine for some time. There was a kyphotic projection in the middle dorsal region, and healed cicatrices in both groins, — the remains of five successive sinuses which followed double iliac abscesses. He was in good flesh and health. The abscesses had opened themselves, and the sinuses had remained open for years, but had finally closed and had remained continuously so for a long time.

The following case illustrates the spontaneous disappearance of an abscess without treatment. A boy of five was referred to me by Dr. Langmaid, presenting Pott's disease in the lower dorsal vertebræ and a fluctuating swelling in the right groin, with the characteristics and accompanying symptoms of iliac abscess of a small size. It was decided by the mother not to undertake any treatment, and he was not seen until four years later. According to the mother's statement, the swelling in the groin increased gradually and descended down the thigh, but finally grew smaller and disappeared. At the time of the second examination the boy presented the usual appearance

of a case of Pott's disease which had recovered in the rounded kyphotic projection and small stature. No trace of an abscess could be found.

The following three cases will illustrate the course of abscesses under expectant treatment: —

B., boy of five, with sharp angular projection for mid-dorsal Pott's disease; treated by recumbency, a plaster jacket, antero-posterior support. Developed three years later a large abscess, which descended to the outer side of the thigh and finally, after becoming of very large size, opened spontaneously. A sinus remained for six months, but finally healed. The patient remains at the present time, a year later, in excellent condition, being able to run about as freely as other boys, but wears for protection an antero-posterior support.

P., boy of five, with mid-dorsal Pott's disease of three years' duration, presented a large tumor of the size of two fists, with psoas contraction in left inguinal region, which did not diminish under purgatives, but had the characteristics of a deep iliac abscess. The patient was treated by absolute recumbency for a year, and at the end of nine months the tumor began to diminish in size and finally to entirely disappear. The boy was allowed to go about with an antero-posterior support, and at the present time has every appearance of being quite well, without any trace of the abscess.

H. P., a boy of four, is a counterpart of the above case, except that at the present time although the abscess has diminished to one half the size first seen, there is still a small tumor to be felt in the right groin. The boy, however, is in excellent condition, and is able to play about freely.

It cannot, however, be inferred that absorption or encysting of a large abscess is the rule, either with or without treatment. Cases like the following are unfortunately not exceptional: —

J., a girl aged sixteen, of good flesh and apparent health, but with a distorted hip, from a hip disease of early childhood, presented signs of lower spinal caries, and developed a left inguinal abscess, which afterwards became psoas, finally burst, giving rise to hectic and eventually death from septæmia and exhaustion.

In how many cases expectant treatment may be relied upon as safe and in how many the result is disastrous, it is impossible to state, as statistics are wanting. We may, however, accept the statement of Trevis, that the most frequent cause of death in Pott's disease is from abscess and its sequelæ. (Vide International Encyclopædia of Surgery, art. Pott's Disease.)

In fine, it will be readily admitted that the treatment of abscess by expectation has its limits.

The methods of treatment apart from that of expectation are:

1. That of repeated aspiration.
2. That of injection of fluid to promote absorption.
3. That of incision.

The former will be found to be unsatisfactory in many cases, for the reason that the aspiration does not remove the caseous clots, but only the serous and sero-purulent fluid, — the least dangerous part of the contents of the abscess, and easily renewed by subsequent effusion.

It is probable that aspiration favors absorption. Repeated aspiration, in weakening the wall of the abscess at one point, favors pointing and discharge where absorption does not take place.

In regard to the question of the cure of abscess by the injection of fluid, there is but little as yet definitely known in cases of large abdominal abscesses, as the method has been in use but a comparatively short time.

Hyperdistention with carbolic-acid solution, proposed by Mr. Callender, is dangerous from the possibility of carbolic-acid poisoning.[1] Whether iodoform or corrosive sublimate or sulphurous acid can be used with safety, is not yet decided. If, however, there is danger, in all probability in iliac and lumbar abscesses it will be at its greatest, owing to the sinuous channel and pockets of these abscesses, and the liability of retention of a larger quantity of injected fluid than was intended.

The question of incision would theoretically be easily answered.

[1] The writer recorded a death in a boy of five after washing a small cold abscess from hip disease with a few ounces of one to forty solution of carbolic acid. Bost. Med. Gazette, 1880, vol. vii. p. 478; Fränkel, Wien. Medisch. Woch. 1884, p. 34; Vincent, Med. Press. and Circ. 1877, vol. xxiv. p. 529.

An abscess is an abscess wherever it is situated, — a source of danger to the patient. When it is not absorbed, it should be incised and the contents evacuated.

In opposition to this aphorism, we have the teachings of the older surgeons, which come to us as a tradition, that large cold abscesses are to be left to nature; the manifest dread most surgeons appear to have in opening a large pus cavity; and the fact that experience in many cases of incision would show that opening the abscess sometimes would appear to be injurious and in fact to hasten death. This dread has been materially diminished since the introduction of antiseptic surgery, but even under careful precaution it is difficult to guard for months against possible sepsis. And in many of these cases of lumbar and iliac abscess it is impossible to obtain primary intention, as it is impossible to reach the original focus of disease.

Cold abscesses from caries of spine differ from cold abscesses elsewhere in this, — that, to reach the surface of the body, the channel is long and often tortuous. It follows from this that the external appearance of the abscess may give no indications of the state of the original disease, or of the existence or non-existence of sacs along the course of the channel leading to the original caseous lesion of the spine. These sacs may be entirely separated by layers of fasciæ, except perhaps through a small opening found with difficulty at the time of operation; and in evacuating one the other may be imperfectly drained.

In certain cases, therefore, the incision of the abscess at the surface is not followed by relief, and may be the prelude of the patient's decline and death.

The following cases will illustrate: —

M. F., a girl, aged fifteen. Caries of spine since she was nine years old. Large iliac and psoas abscess in right groin. Patient in excellent general condition; has been treated by recumbency, plaster-of-paris jackets, and an antero-posterior support. Is able to go about freely. Operation of incision of abscess undertaken, as the iliac abscess had increased rapidly, and had occasional swelling of the leg. Abscess incised by double incision in groin and upper part of thigh. The patient did well for three months, but at that time began to fail. A second iliac abscess formed

in left side, which burst spontaneously; the patient died, six months later, of exhaustion.

B., a woman, aged thirty-eight. Large psoas abscess. Patient in poor general condition, but able to go about freely. Abscess incised aseptically. The patient did well for a month, only a sinus remaining; a second abscess formed on the same side and above the first opening. This also incised. Patient gradually lost strength, and died two months after last operation.

In many cases where the abscess is quite thoroughly localized, the incision of an abscess is little more than the lancing of a boil. The abscess has worked its way thoroughly to the surface, and the channel connecting the abscess with the spine is closed or nearly closed, and the original point of disease in the vertebra is in a quiescent stage.

L., a boy, aged five, with lower dorsal caries. Abscess left groin, near the anterior superior spine. Incised just before spontaneous opening; several ounces of pus evacuated. No disturbance from incision; small sinus remaining. Boy much improved, and a few months later running about freely.

H., a girl, aged four; a counterpart of the above, except that the abscess had descended to thigh. Abscess healed entirely six months after operation, and the child has remained free from recurrence since two years, and is in excellent condition at the present time.

The matter is an entirely different one when we are dealing with large abscesses projecting into the abdominal cavity, and which may be termed abdominal abscesses. These may not differ in appearance, under inspection or on palpation, from perityphlitic abscesses or other collections of pus underneath the peritoneum and pressing into the peritoneal cavity.

A certain number of these abscesses remain encysted, and occasion no trouble. Others end in a spontaneous rupture, bursting in various directions, the overflow coming to the surface of the skin or intestine, discharging, leaving a sinus which may heal, perhaps, or remain with a slight discharge; while the main body of the abscess has discharged its overflow in another direction, leaving another sinus, until several sinuses are formed. In some instances, following the abscess in one groin, a second may

appear in the other, — two outlets from the central abscess around the diseased vertebral bodies. The spontaneous rupture into the rectum or intestine is often not the occasion of any disturbance; and in some instances the abscesses have entirely evacuated themselves in this way, and given rise to no further disturbance.

The records of the autopsy-room, however, show that so fortunate a termination is by no means the rule.

A patient presenting a large abdominal abscess may be treated conservatively; but before the stage is reached when the abscess is no longer a threat, a long period of time is needed, during which the most favorable conditions are needed.

W., aged twenty-five. Caries of spine in lower dorsal region since she was a girl, with apparent recovery, for four or five years. A large abscess formed in left iliac region. Patient treated by a plaster jacket, recumbency, aspiration. Abscess diminished in size. Patient improved very much, but died five years later with symptoms of tubercular meningitis.

As it will be readily admitted that in certain severe cases expectation in large abdominal abscesses is followed by disastrous results, there is no need of argument in favor of preventive measures if any may be regarded as effective and safe.

Free radical incisions have been advocated by König, Treves, Andrews, and others. The following cases may serve as an illustration of the method: —

H. P., a boy aged ten, with mid-dorsal caries of the spine, presented a large tumor high up in the left iliac region; semi-fluctuation could be felt in deep palpation, by pressure on the back, between the last rib and the crest of the ilium, and in front deep in the inguinal region. The boy was in comparatively poor condition, showing by his appearance the leucocythæmia of suppuration. The tumor was of the size of the head of a full-term fœtus, and was entirely beneath the skin or muscles; there was no evidence of any tendency to point.

The tumor was reached by a lumbar incision parallel to the spine and two inches to the outside of the spinous processes. The muscles, fasciæ, etc., were divided, and the sac of the tumor reached and palpated with the finger. The abscess was punctured by means of a trocar, then incised, sound introduced, and

a counter opening made in front in the groin. The contents of the tumor were found to be a caseous mass of the consistence of cream cheese; large drainage tubes were introduced in front and behind after the abscess cavity had been freely washed out with a weak corrosive solution. No disturbance of moment followed the operation. Five months later a small abscess was found in the right groin and incised.

At the present time, eleven months later, the boy is in unusually good condition. The sinuses on both sides have healed; the one in the back is intentionally kept open by means of a large drainage tube, and there is a slight sero-purulent discharge. The boy has lost the leucocythæmic appearance of chronic suppuration, and is in good color and flesh; he is free from psoas contraction, and is able to play about freely, wearing an antero-posterior support.

The benefit obtained by the operation is manifest; the patient was entirely freed from a large tuberculous mass, protruding in the abdominal cavity, which not only was a detriment in itself, diminishing strength, but was a threat as to the future. It would certainly have required years of expectation before a double iliac abscess would have evacuated itself and healed, and it would seem hardly probable that so large an abscess in a growing boy in poor condition would have become entirely encapsulated or eventually absorbed.

The following cases are similar in the main to the foregoing:

H., a negro boy, aged six; operated on Dec. 16, 1885, for left iliac abscess. Asepsis not perfect; and some suppuration followed after opening the abscess, and slight fever. Condition one year and a half later, excellent. Slight discharge from sinus in groin. Great improvement in flesh and strength, able to go about well.

R., a boy, aged three years eight months. Child in a very feeble condition; iliac abscess. Abscess opened August, 1886. Child examined May, 1887, and in much improved condition, free from abscess, a small sinus remaining. Able to walk about wearing a brace, but still has evidence of caries of the vertebræ.

M. B., a boy, three years old. Abscess aspirated twice, after-

wards opened. Patient heard from three years later as able to run about.

F., a boy, aged six; operated on, Dec. 9, 1885; discharged from treatment six months later. Patient heard from, a year later, as not doing well from a reappearance of symptoms.

C., a boy, aged ten. Large left iliac abscess. Operated on, with little disturbance to patient and prospect of favorable result. Two weeks after operation, however, patient contracted scarlet fever and died.

T., a boy, aged eight. Large right iliac abscess; boy in poor condition. Four months after operation, appearance of left psoas abscess. The patient became greatly reduced and suffered much pain. He was operated upon in the same way on the left side, and a large amount of pus removed. The patient was much improved by the operation, and at the present time, ten days after the operation, is doing well.

In all of the above cases the patient's condition was improved by the operation. In the first two it may fairly be said that quite a step has been taken toward ultimate recovery from the caries of the spine, and that the operation relieved the patient from an important impediment toward recovery. In none of the others was the lack of ultimate improvement attributable to the operative measures, which would appear to be without danger if taken with care.

It is impossible to define in what cases operative interference is demanded and when expectant treatment is more advisable.

It is probable that a spontaneous opening of an abscess, if occurring when complete drainage of the whole abscess (and not leakage of the overflow) is possible, is better than operative incision, because spontaneous rupture takes place under pressure within the abscess cavity, and the internal pressure distends and obliterates sacculi, thus allowing a more thorough evacuation than is possible during a stage of less distension. Where, however, the abscess is so situated that complete spontaneous evacuation is not possible, or where the abscess itself impairs the patient's physical condition, and constitutes a menace as to the future result, operative interference is advisable.

It should be borne in mind that the prognosis after incising

an abscess is better in children than in adults, that strict asepsis is requisite, and that complete and thorough drainage is essential for the best obtainable result.

Discussion.

Dr. Hodgen, of St. Louis. — Mr. President: In connection with this paper of Dr. Bradford's, I wish to say that yesterday I spoke of aspiration of the abscess in connection with Pott's disease simply as the first step in the treatment. I am an advocate of freely opening the abscess when the time comes for such treatment. But I am not an advocate, I am a decided enemy, of leaving an abscess alone. You cannot tell where it may excite mischief which you cannot control.

Dr. L. H. Sayre, of New York. — Mr. President: As related to the cases the histories of which Dr. Bradford has given, I may cite the following: A little girl, about eight years of age, was struck in the dorso-lumbar spine about eighteen months ago by the corner of a door. Pott's disease followed, but she recovered apparently with little deformity. She came under my notice about two months ago, at which time there was a large swelling in the lower part of the abdomen. About four months ago there was a swelling in the right thigh, evidently connected with the psoas abscess. That disappeared. When I saw the patient there was a swelling the size of a Florida orange in the right iliac fossa, which I aspirated and withdrew some pus, but the size of the tumor was not apparently diminished. I reintroduced the aspirator, but got nothing more. A plaster-of-paris jacket was applied. Three weeks ago, thinking that it was not safe to leave the abscess, as it commenced to show indications of spontaneous opening, I opened it. On cutting through the skin and superficial fascia, about fourteen ounces of pus escaped, which lay above the abdominal muscles. I then discovered that the pus welled up through the external abdominal ring. I then enlarged the opening through the abdominal muscles, and found that the abscess within was filled with cheesy material and broken-down bone substance from eroded vertebræ. I made a counter-opening through the lumbar muscles opposite the first lumbar vertebra, put in a large drainage tube, and left it until next day, when the temperature was about 103.5° F., — what it had been before the operation. I re-dressed the wound, let out some pus lying between the

muscles and external walls, introduced another drainage tube, since which the patient has done well.

Dr. Bradford. — Mr. President: In certain cases of abscess in which I have operated there has been sequestrum; in others none. I think a large number of cases give a history like Dr. Shaffer's, but iliac abscess does not always become encysted and hard, or semi-fluctuating, even under treatment. Now, I think, from experience, that, in children at least, the operation is not dangerous.

NOTES ON TWO CASES OF POTT'S DISEASE.

Illustrating the difficulty of diagnosticating between upper dorsal and lower cervical caries in very young children.

BY JOHN RIDLON, A.M., M.D., NEW YORK.

I DESIRE to present to you notes on two cases of Pott's disease. They are as follows:

Case 1. — Male, born of healthy parents, and with hereditary history free from tuberculosis, scrofula, or syphilis, so far as can be ascertained. When six months old he began to throw his head backward and show evidence of pain when the head was moved. This condition increased until, after four and a half months, the head rested on the shoulders and could not be bent forward from that position. Lateral bending in either direction was also equally resisted, and there was but slight rotation. The chin looked forward and upward, and the sterno-mastoid muscles were equally prominent. Any attempted movement of the head caused screams of pain, and the mother was constrained to nurse him on her knees by the cradle. There was no evidence of kyphos at any point. The finger was not passed into the throat. He started and cried in his sleep, and had grown thin.

Case 2. — Male; has a good hereditary history, so far as can be learned, with the exception that one grandmother had "consumption." The child was healthy up to the ninth month. After that he had a cough and was sickly; when twenty-eight months old he began to throw his head backward and show stiffness of the neck. There was little or no complaint of pain, but there was restlessness in sleep. He was a fat but flabby child. At the end of eight months he walked with head thrown well back, almost resting on the shoulders; chin looking forward and upward; sterno-mastoid muscles equally prominent, and no facial evidence of pain. The head can be thrown back-

ward to the normal; bent to either side somewhat, but cannot be bent forward; on attempting the latter he cries with pain. There is slight possible rotation. He eats and sleeps well, and shows no evidence of pain when left to himself. There is no evidence of kyphos anywhere.

Now, to what condition did these symptoms point? That there was spinal caries, there could be no doubt. The position of the head, thrown far back, its weight supported by the elevated shoulders; the muscular rigidity limiting forward bending, but permitting backward and to some degree lateral bending and rotation; and the equally contracted sterno-mastoid muscles pointing the chin directly forward, taken in connection with the absence of pain about the chest and epigastrium, the absence of paraplegia, and of kyphos after, in the first case four, and in the second eight months without treatment, led me to locate the caries in the lower cervical vertebræ.

The progress, however, showed the error of my conclusions; and this is my excuse for presenting these cases. The treatment in both was the same. They were put in bed, on their backs, and traction was made by means of a sling about the head and pulley and one-pound weight. In the first case, the ten-months-old baby, at the end of three days the pain was greatly relieved; he slept quietly, and the position and motions were greatly improved. After five months the head was in normal position, and could be freely moved when resting on the pillow; but the patient could not sit up, and could not move his legs. The tendon reflexes in the lower extremities were greatly increased, and there was found to be a sharp, angular kyphos, involving the first, second, and third dorsal vertebræ. In the second case, after three months, the head was in normal position, and could be moved freely when resting on the pillow. The patient could sit up and hold the head in the normal position a short time, and there was no evidence of pain except when the head was bent forward with some force. Four months later, the case having progressed favorably as to the neck symptoms, the tendon reflexes of the lower extremities became exaggerated, and an examination of the dorsal spine revealed a kyphos, involving second, third, and fourth dorsal vertebræ.

The lesson taught me by these cases is this: that in *very young* children caries of the upper three or four dorsal vertebræ may give symptoms referable only to the neck, and should lead us to exercise great caution in diagnosis when the symptoms point to disease in the lower cervical region.

Discussion.

Dr. Ketch, of New York. — Mr. President: I can bear testimony to one point brought out by Dr. Ridlon. I have not unfrequently seen what has been diagnosticated cervical Pott's disease in young children which afterward proved to be disease in the dorsal region. This fact came strongly to mind the other day when a child about eighteen months old was brought to the clinic. The diagnosis of cervical disease had been made, based on the neck and head symptoms just referred to by Dr. Ridlon. A Taylor's splint and chin piece were prescribed, but for some reason they were unable to attach the chin piece. The child went away, and was not seen for some months, when I found that it had well-marked disease in the dorsal, and not in the cervical, region.

ROUND SHOULDERS.

BY CHARLES F. STILLMAN, M.S., M.D., NEW YORK.

The case which is presented to you to-day is one of a very common type, and one that will be met with quite often in practice. By far too large a proportion of the adults of the present generation are afflicted with this deformity, to which the name Round Shoulders has been given, as expressing most nearly the condition to the ordinary observer.

More strictly speaking, this deformity should be called the Antero-posterior Curvature. It seems to increase in proportion with the indolent tendencies of civilization. It is easily remedied, and even in its advanced stages the condition can be greatly improved by proper treatment.

In order to understand the curvature itself, there are certain principles involved, which must first be studied.

The natural development of the human body is symmetrical, or nearly so. To a certain extent this is modified by the pernicious habit of exercising one side of the body more than the other, this being especially marked in the use of the upper extremities; those using the right hand habitually possessing greater development of the right side, while those using the left hand possess more development of the left side of the body, it being rare to find people who are ambidexterous, which condition renders the body more nearly symmetrical.

The spinal column is composed of a number of vertebræ, between which sufficient motion exists to permit bending in all normal directions; and these vertebræ are prevented from irregular or excessive movement by ligaments, and these movements are controlled by a muscular system which responds both voluntarily and involuntarily to the action of the nervous system.

The maintenance of the body's gravital centre depends upon, first, the perfect development of muscles; second, upon the per-

fection of their tone; and third, upon their complete obedience to the action of the nervous centres.

The muscles governing the spine are under the influence of two kinds of nerve-force, — first, voluntary; and second, involuntary.

Voluntary impulse is demonstrated in many ordinary actions, such as stooping, bowing, bending, and twisting the body, these being consciously and intentionally made; while the involuntary impulse, which controls the balancing of the body and its maintenance in an erect position, is entirely irrespective of volition or consciousness, and it so stimulates the spinal muscles that they constantly keep the centre of gravity of the body at the proper point, and cause its restoration, should it by accident be changed even for a moment.

It is to the perfectness of both the voluntary and involuntary nervous forces that the maintenance of this equilibrium in a healthy body is due.

Loss of shape, or deformity, will arise from one of two causes; either from abnormalities in the construction of the skeleton itself, — for example, the shortening of the leg in hip disease, in which case the attempt of the body to balance itself on an uneven base brings about deformity, — or from irregularities in the development and action of the voluntary and involuntary muscles.

In the natural condition, the spine exhibits several well-known curves, constituting the pose of the neck, the moderate roundness of the dorsal region, and the incurvation of the loins; but in the deformity we are considering to-day, this natural curve has become exaggerated and symmetry disappears.

Heather Bigg divides the natural body into a mathematically erected structure, with a triplet of arches, the lowest of which is formed by the legs and feet. These he calls the base. The spine itself constitutes the second; and the upper mass of the body, comprising the head, arms, and trunk, he calls the burden, — this burden being, in a natural and healthy condition, evenly disposed, bilaterally balanced, and arranged symmetrically around the spine both in weight and form.

These three factors — base below, spine in the middle, and

burden above — form together the integral whole of the body, and are kept in the proper position one above the other by muscles obeying gravital law, and are relatively reliant on each other one above the other; and if anything directly affects the normal condition of one of these factors, it will also affect indirectly the condition of the others.

That author, therefore, argues that the development of this curvature of the spine can be of intrinsic origin and arise from alteration of the spine itself; or that, while the spine is mechanically perfect and healthy, the other factors, — that is, the base below it, or the burden above, — being abnormal, may so react upon the spine as to cause a deformity in it; and in this case the deformity is of extrinsic origin.

The curvature has several synonyms; "kyphosis" being perhaps the best, since it means "round or bent-backed." In the French, this is "lordose;" in German, "Spitzbuckel winkelformige knickung der wisbelsaule, Ruck verbiggung der wisbelsaule;" in English, "spinal excurvature" or "posterior deformity."

In variety, it may be either complete or partial, or may be divided, according to the time of life in which it appears, into *infantile*, *juvenile*, and *senile;* and it should not be confounded with the posterior deformity attending caries of the vertebræ.

With regard to its causes, some writers look upon round shoulders as exaggerations of the normal spinal curves. There are many exceptions to this rule.

At birth there are no curvatures, and it is only at a later period, when the child has been accustomed to sit or stand, that the antero-posterior curvatures are developed, these being produced by the muscular action which maintains the equilibrium of the spinal axis, which the weight of the burden — that is, the head and upper extremities — tends constantly to displace. These antero-posterior curves become gradually formed, and increase with the child's age.

We thus quickly obtain the antero-cervical curve, the postero-dorsal, and the antero-lumbar.

The principal causes in the production of this curvature are, obviously, a constant disturbance of the normal gravital centre

and the unsymmetrical action of surrounding muscles, which being allowed to continue indefinitely lead to severe and permanent changes in the bones.

Many inherit the tendency; or it may be due to mechanical causes acting on the spine affected with rickets, while the senile forms may be introduced by rheumatism or gout.

It usually arises from general debility of the system, and is liable to overtake any one in times of great constitutional weakness, and more particularly those in whom growth is yet incomplete. Children in the years between puberty and maturity, and especially those whose growth has been very rapid, are most frequently the subjects of this deformity; as are also convalescents from severe illness, or those suffering from collapse after great mental or nervous exhaustion.

The pathological changes in this deformity are usually confined in the spine to the anterior parts of the vertebral disks and bodies, the transverse processes being separated from each other, and the laminæ flattened and shortened; in some cases, also, the spinous processes are separated abnormally.

The vertebræ most commonly affected are the fifth, sixth, and seventh dorsal; and in some cases the intervertebral disks measure only one half, or even less, of the usual thickness. If this deformity be of long duration, and in some of the senile forms, the intervertebral disks may have disappeared entirely, and the bodies become ankylosed both centrally and peripherally. In the former, bony ankylosis occurs between the laminæ, articular processes, and the spinous processes; while in peripheral ankylosis the anterior common ligament becomes ossified without primary changes in the bone itself.

Changes are also produced in the thorax, the vertical and transverse diameters of which are diminished, the antero-posterior diameter being increased; intercostal spaces are diminished, the ribs becoming more or less straightened, the upper ones being nearly perpendicular to the spine, while the lower ones are oblique; the sternum is usually convexed in front, but in some cases it may be depressed in its middle part.

In infantile curvature, which is most often due to rickets, the most frequent seat of the deformity is in the dorso-lumbar re-

gion; while in the juvenile form the middle of the dorsal region is most commonly affected. In this case the head is usually carried forward, the chin approaching the sternum, the posterior portion of the scapula being raised and standing out; and in cases of long standing, a compensatory lumbar lordosis occurs, the abdomen projecting, and the trunk being carried backward, so as to maintain the equilibrium.

Juvenile kyphosis is more common in girls than in boys, and is most frequent about the age of puberty, and is generally due to a general relaxation of the system and of the spinal muscles and ligaments, mainly caused by vicious attitudes in writing or in studying at school.

The senile kyphosis occurs later in life, and is usually induced by faulty positions assumed during business hours through life, or as a result of gout or rheumatism; and the deformity is usually much more marked and intractable.

The treatment of round shoulders may be considered under two heads, — *physical* and *mechanical.*

Physical treatment involves the employment of such exercises and movements as will conduce to the proper strengthening of the deficient muscles, and also tend to diminish the deformity itself.

The first exercise to which your attention is called necessitates the use of a table. For this purpose employ either a table or lounge or couch the surface of which is padded or covered so as to be comfortable to the patient; and it should be low, so as to divest the patient of all fears of falling while undergoing the exercise. The patient should place himself or herself in the extension position; that is, the edge of the table should come to the central dorsal region, the patient lying upon the back, and the head and upper extremities should hang over.

When this position is assumed, it will be seen that the chest has a tendency to resume its normal shape, that it loses its contracted appearance, and that the shoulder blades tend to approach each other. To approximate the scapulæ still further, the patient may clasp the hands together posteriorly; and while undergoing this process, it will appear that the skin and tissues of the anterior portion of the thorax are stretched as much as

their structure allows, and that posteriorly the soft parts become relaxed.

Dumb-bells of various sizes are now taken in the hands, and a series of rapid lateral movements practised, which still further expand the chest. There are quite a number of calisthenic exercises which are of advantage if practised in this horizontal backward traction position; but they must be employed with care and moderation, as their expanding effects are so powerfully augmented by gravity that they may strain the tissues painfully and thus delay treatment.

A most useful agent is also found in the rubber cord. Of these, there may be two, fastened by hooks and staples to the floor in such a manner as to draw the hands beyond each other; the resistance of the muscles to the contractility of the rubber constituting a most valuable agent for the development of the chest, if formulated into a series of exercises.

This *horizontal backward traction position* should be practised daily at least twice, and from fifteen minutes to half an hour at a time; and it is very efficacious.

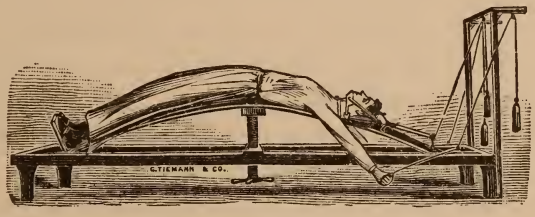

Fig. 11.

A second form of exercises is upon the horizontal curved traction frame, which the author has recently devised. It consists (see Fig. 11) of a curved board, the curve of which can be regulated by means of a screw, and provided with traction apparatus at its upper extremity and foot rests at its lower. It can readily be seen that when the patient lies upon this curved board and traction is exerted upon the spine, the deformity will tend to disappear without fatigue to the patient; and that while in this position, if the arms be systematically exercised by means of the pulley and weights attached to the frame, the deficient muscles

can be exercised to the very best advantage, while the traction force is at the same time exerted upon the spine itself.

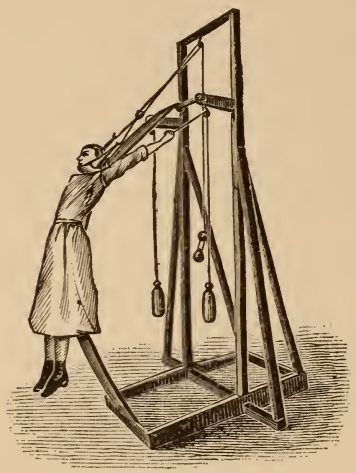

Fig. 12.

The third form of exercise is that of the vertical curved traction frame, also devised by the writer. This resembles the frame just described, except that the apparatus is vertical instead of horizontal, as seen in Fig. 12.

It consists of a curved board against which the back of the patient rests, and is also provided with traction apparatus and pulleys and weights.

On this frame, after the suspension is adjusted, two forms of exercise may be employed: first the muscles of the upper extremities and chest will be strengthened by means of the pulleys and weights; and second, the muscles of the lower part of the back are developed by means of kicking exercises, the traction on the curved board being, of course, constant during both. The use of this frame is particularly serviceable in strengthening the muscles of the back and reducing the deformity.

There are also certain postures which may be recommended in addition to the regular exercises. The first is the prone posture (instead of the supine), the patient reclining upon the front of the body during the day, lying at full length and resting upon the elbows. The second is to have during sleep both bolster and pillow removed from the usual places under the head, and one or both placed under the shoulder blades, thus bringing the head somewhat below the dorsal region and tending to curve the spine in the direction opposite to the position of the deformity; so that during sleep the posterior spinal muscles are prompted to recover some of the contractility lost during the day when the erect position is being maintained.

The mechanical treatment consists in the use of properly de-

vised apparatus for the restoration and retention of the normal curves; and the mechanical problem thus involved is resolved into the reduction of the dorsal curve, since the cervical and lumbar are merely compensatory and tend to regulate themselves.

By the use of the table we have obtained great improvement in the condition of the deformity; and the question arises, How are we to retain this improvement when the vertical position is again assumed, as the posterior spinal muscles are impaired and have not sufficient power to hold the spine in its restored curves.

Although in slight or recent cases this can be accomplished by simple methods, yet a brace will often be a necessity in severe cases; and it is easy for us to construct one upon the principles which govern the reduction of the deformity.

We must strive to keep the patient in a state of hypererectness until the muscles have been exercised and invigorated sufficiently to render the use of a brace unnecessary; and a satisfactory method of utilizing backward traction in the formation of a brace is one constructed on my adjustable "V" lever plan, the fulcrum to be over the sacrum, the resistance to be greatest just below the central region of the dorsal curve and distributed all along the spine below this region, and the power to be the forward tendencies of the upper extremities and head, so that while the body is maintained erectly no force is exerted upon the spine at any point, but the least tendency to rounding the shoulders brings a power to bear exactly opposed to the power of the deformity, which increases automatically in proportion to the extent of the deformative force.

To construct a brace so as to bring the proper forces to bear under these conditions, we place a girth, provided with a sacral projection, about the hips (Fig. 4, page 18). From the upper edge of this hip girth springs a pair of metal strips, one on each side of the median line, so as to avoid the spinous processes; and these strips extend upwards to the middle dorsal region and terminate in a pressure pad (Fig. 4).

So far the brace is a substitute for the table; but to give it efficacy we must supply a frame for backward traction as a substitute for the backward force exerted by the weight of the upper extremities, when the body is in the traction position.

To effect this, a light steel frame moulded to the shape of the back and extending from the sacrum to the cervical vertebræ is attached at its lower extremity to the hip girth (see Fig. 4), and there provided with ratchets, which admit of its being secured at any angle. The upper extremity of this frame is secured to the body by means of axillary crutches terminating in pads over the acromion processes.

The action of the brace is that of a lever, exerting its force in such a manner as to distribute its pressure along the spine, the dorsal centre being the point of greatest pressure, and the sacrum the least, the intermediate pressure being so graduated as to decrease from the dorsal centre to the sacrum. We thus see that direct pressure is provided to the greatest degree where it is needed most, that is, at the dorsal centre, and in the least degree where it is needed the least, over the sacrum; and there is thus no portion of the spine below the dorsal centre without support. This support and forward pressure is just in proportion to the backward angle of the brace frame and the forward tendencies of the deformity. In the beginning of the treatment the brace frame may be secured at a considerable angle; but as improvement ensues, this may be lessened until it lies flat upon the padded strips, and becomes in its action a mere spinal support instead of a lever. In severe cases a removable head-piece may be added, as in Fig. 5, page 18.

This brace makes an extremely effective and comfortable instrument, and can be made to exercise any desired degree of power on the deformity. But there are many cases which do not require so pronounced an instrument as this, — cases in which the youth and immaturity of the patient have not as yet allowed the parts to become habituated in the abnormal curves to such an extent as to demand its use.

Such cases require merely a light, strong, compound spring, or pair of springs, which will act supplementary to the impaired muscles of the back; and this spring power can be so adapted to the form as not to be apparent to an observer that the patient is wearing an aid of this kind.

A PRACTICAL POINT IN THE TREATMENT OF POTT'S DISEASE OF THE SPINE.

By A. B. JUDSON, M.D., NEW YORK.

The treatment of Pott's disease is always open to amendment. I propose, therefore, in order to assist the practitioner, a simple rule, as follows: The efficiency of the apparatus used is to be measured by the condition of the skin covering the projection.

A few words in explanation will not be out of place. It is premised that the object of mechanical treatment is to make pressure on the projection, with the threefold object of (1) enforcing fixation of the bones involved, (2) transferring pressure from the diseased bodies to the healthy processes, and (3) lessening the deformity. If we were dealing with the skeleton deprived of its integument, there would practically be no limit to the pressure which might be applied to the projection. But the interposition between the apparatus and the vertebral column of the sensitive skin places a peremptory limit to the degree of force which it is possible to apply. The rule may therefore read: The apparatus may be considered as having reached the limit of its efficiency if it makes the greatest possible pressure on the projection compatible with the comfort and integrity of the skin.

This rule may be followed with perfect regard to the comfort and convenience and relief of the patient. If, contrary to common-sense, the apparatus is fastened at once as tight as it can be borne, the skin will react speedily with pain and ulceration. But if the pressure is lightly applied at first, as may be conveniently done with apparatus constructed with this in view, and gradually and carefully increased from time to time, it will be found, as the weeks and months go by, that the skin has become indurated without losing its integrity or causing in-

convenience, and its condition will be unimpeachable evidence that, so far as mechanical means go, the patient is receiving a full measure of the benefit of treatment.

Through the negligence of the nurse or the wilfulness of the patient, apparatus designed for use in this way may produce and occasionally has produced abrasion and ulceration. But this should not be considered a good reason for condemning the apparatus. It is well to bear in mind that the disease in question is perhaps the most insidious in its progress and disastrous in its results of all the affections to which the young skeleton is liable. Shall we not make use of the most efficient method at hand, and if necessary redouble our carefulness and painstaking in order to avoid incidental excoriation?

There are methods of treatment to which the rule proposed does not apply very closely. I refer to those methods which have for their principal features suspension and plastic dressings. If the patient is suspended and plaster of paris applied the pressure is diffused rather than concentrated, and changes in the skin are less marked, and it is less easy to adjust the direction and degree of pressure on given points, while it is especially easy and convenient to do this with a brace constructed of tractable steel. I would not decry the use of plastic dressings in the treatment of this affection. They are daily affording comfort and relief to numbers of sufferers who would otherwise have nothing done for them. They will continue, perhaps, to be used by the general surgical practitioner. But I think the specialist in orthopedic practice can do better. He has a better method at his command, in the use of tractable steel modified to meet the varying requirements of the case, to which he devotes himself with the patience and ingenuity which are a part of his equipment.

To the practitioner of this class I commend the rule suggested above, to the effect that the question of the efficiency of the apparatus is to be determined by the condition of the skin covering the projection, — a rule which many of us have doubtless followed in practice, and which it can do no harm to have expressed in words.

Discussion.

Dr. John Ridlon. — I fully agree in all Dr. Judson has said. I only rise to make this addition: It seems to me that every now and then we have cases which we fail to fully support by any form of steel or plastic apparatus that has been my fortune to see. In such cases we are compelled to resort to the recumbent method. If, then, the recumbent method is absolutely necessary in the worst cases; if a patient improves in general health while in the recumbent position; and if we can give him plenty of fresh air and sunlight, — I do not see why we should hesitate to so treat the patient and I fail to see the necessity of putting him on his feet and making him walk around. I believe that the immediate cases, and even the milder ones, are benefited by the same energetic treatment which we use in the worse cases.

REPORT ON THE TREATMENT OF CLUB-FOOT BY MEANS OF THE THOMAS WRENCH.

BY V. P. GIBNEY M.D., NEW YORK.

Mr. President and Gentlemen of the Association: I desire simply to report some cases, with presentation of the apparatus employed, which is known as the Thomas Wrench, for forcibly correcting club-foot at one sitting, or, if that is not necessary, take other sittings. The apparatus consists simply of a modified monkey-wrench on a large scale, with arms jutting out from the side, which arms are controlled by a screw, and which take hold on the foot over the astragalus at one point, and in the plantar arch of the other point of pressure. The foot is placed in the wrench and the screw tightened, then the arms brought in close proximity until we get a good purchase or grip, then by means of a lever you can bring an ordinary club-foot, or the kind of club-foot we are familiar with — namely, the relapsed club-foot, the uncured ones — into a good position. I think, Sir, the Association will agree with me that the majority of cases of club-foot we have to treat are those that have been under various forms of treatment, that we fancy we have cured ourselves on former occasions, and find, on looking the matter over again, there is still some defect; we do not get the foot into a good normal position. We get the equinus corrected, perhaps, but the varus is left over, the child walks pigeon-toed, and our attention is not kept closely riveted on the child; we find it rolling after a few months on the outer side of the foot, the inner side of the foot coming up. It does not take long to thus acquire one of these relapsing cases.

Dr. Bradford has drawn our attention to this in the presentation of his tarsal plates; Dr. Morton, of Philadelphia, likewise; and now we are getting to look upon the most formidable club-foot as belonging to that class of cases mentioned, to say nothing

of what is known as untreated cases of club-foot. None of us, I think, claim to cure club-foot in a short space of time. We all recognize time as an important element in the cure of any case of congenital club-foot. The plan that seems to be most in vogue at the present day, I think, is this, not only among orthopedic surgeons, but general surgeons the world over, — to overcome first the varus either by means of apparatus which exercise gradual force, or force under ether at one sitting, and then to overcome the equinus by tenotomy, or by manual or mechanical force combined with tenotomy; in other words, our aim is first to make the case one of equino-valgus. I think we all aim to do that. After we have brought about a typical case of equino-valgus, our aim is then to put the foot into a position of calcaneo-valgus. The difficulties we formerly labored under in producing calcaneus at a single sitting, are not with us at present. I think there is not a single member of this Association, so far as I know, that is afraid to divide the tendo achillis in a case of congenital club-foot, and get the greatest possible amount of extension or separation of the ends of the tendon. I am now confining my remarks to congenital club-foot. In the form known as *spastic* or *hemiplegic* club-foot, some of us still hesitate to make of a case of equinus a case of calcaneus.

To return to the subject under consideration, — namely, the report and description of this wrench for correcting equinus as well as varus, — I may say that its principle is practically that of Dr. Bradford's instrument. The object of his apparatus is to grasp the foot in a position that you would naturally take hold with your hands, getting your fingers over the salient points, then twist the foot into shape. I have used the tarsoclast considerably; yet I confess, when I saw the apparatus which I now present to you, a year or so ago, it occurred to me that this was of a much more simple form, one that any one can use more readily. I find considerable difficulty in using Dr. Bradford's instrument, in having students take hold of it and put it in shape; they do not exactly know where to get the points of pressure; the screws and small pads slip, and some of my New York friends have made that objection to it.

The principle of this instrument is so simple that any one can

wrench a club-foot into very good shape. I think, however, that the best plan is, before attempting to correct completely, if you have an extreme case of congenital club-foot, to first, by means of manual force, convert an equino-varus into a case of equino-valgus, and leave the foot in position long enough for the bones on the outer side of the foot to become atrophied and long enough to hope for some hypertrophy of the inner side of the foot where pressure is removed. Then, after this has been in position long enough, the benefit can be tested in this way: My plan is to leave off plaster dressings for one or two weeks, during which time there is no dressing on the foot. Take the foot and place it on a piece of paper, and make a tracing of the greatest amount of eversion. If at the end of a week or two there has been no disposition to return, I begin then the second part of the treatment; namely, divide the tendo achillis, and bring about both flexion and eversion of the foot by means of the wrench into a case of equino-valgus.

I have used it since last September or October in twenty cases, supplementing it in some instances by manual force.

The following brief abstracts will suffice: —

Case 1. — Male, aged four. Double equino-varus, high degree; never treated. Under ether, April 8, 1888, overcame by manual force the varus, and applied plaster of paris. The dressings were renewed about once a month until August 11, when the case presented a typical equino-valgus. Tenotomy of tendo achillis then without ether, and equinus overcome at once. Dressings renewed once or twice, and on each occasion attempt was made by manual force to overcorrect the deformity. On September 8 it was found that the cure was not complete; and under ether the Thomas wrench was employed, completely reducing all deformity. Discharged September 14, cured; but provided with apparatus which is to be worn for at least one year.

Case 2. — Male, aged fourteen. Double talipes equino-varus from infantile paralysis. Deformity very pronounced, and mid-tarsal region unyielding to manual force. Under ether, May 23, 1888, achillis tendon and tense bands of plantar fascia divided subcutaneously; then with the Thomas wrench the arch of foot

broken down, and a good position obtained; plaster-of-paris dressing. June 20, above procedures repeated, with the exception of the tenotomies. Position mainly perfect; same dressing as before. August 29, operation of left foot, as the right is correct. September 15, discharged cured, wearing ordinary shoes with soles built higher on outer side.[1]

Case 3. — Female, aged sixteen, with both feet in moderate equino-varus of paralytic origin. Patient very stout, and hence slight amount of deformity made walking quite difficult. Had had several achillotomies, and had worn braces for many years. May 25, 1888, under ether, achillis tendons and plantar fascia divided, but deformity could not be overcome until the wrench was employed. With this instrument, deformity overcorrected, and plaster of paris employed. June 21, dressings removed, and feet in excellent position. A pair of common shoes, with outer side raised a little, worn. At present writing, patient walks easily, and expresses herself as fully relieved.

Case 4. — Female, aged nine. Talipes equino-varus from paralysis. Never any treatment until July 27, 1888, when under ether the tendo achillis was divided and the deformity was overcorrected by the Thomas wrench. August 10, cure seems complete, yet precaution is taken to build the shoe up and to wear a brace at night.

Case 5. — Male, aged eleven. Double talipes equino-varus (congenital), of high degree. Apparently much bony enlargement of bones of front and outer side of foot; patient walked on outer side of foot. June 6, under ether, the wrench was employed, after division of tendo achillis, and the deformity was only partially corrected. June 20, operation repeated. June 30, a slough was found on outer side of each foot. Plaster was not continued until wound should heal. September 15, wounds have healed, but there is no further attempt at correcting by means of wrench, as the case seems better suited for cuneiform osteotomy. This case is practically a failure.

Case 6. — Male, aged eleven, with double talipes equino-varus (congenital), relapsed. Cured once or twice and discharged from hospital; but at date of readmission, March, 1888, the

[1] November 10. — Recently seen, and feet still in excellent position.

varus was pretty well marked in both feet. Treatment as in above cases was resorted to, and a good position obtained. On April 4, operation repeated. August 17, patient discharged, with relief say of about seventy-five per centum, with shoes built up on outer side; the case is to be kept under observation.

Case 7. — Male, aged nine. Double talipes equino-varus (congenital), relapsing. Treated for many years at hospital, both in and out-door departments. February 17, subjected to treatment as above, and on April 4 operated upon the second, and May 16 the third time. August 14, discharged, walking with feet squarely on floor and without apparatus. Some precaution as in above cases taken to avoid relapse.

Case 8. — Male, aged four. Double talipes equino-varus (congenital). Deformity quite marked. Achillis tendon had been divided five times, and deformity had relapsed after each. January 7, treated as above; a fair position being obtained. April 4, operation repeated on both feet. Tenotomy not employed in either instance. June 11, common shoes, built up as usual. August 7, discharged, with ability to flex feet to 90° and evert to normal limit. Provided with pair of braces to be worn at night, and to be kept under observation at out-door department.

Case 9. — Female, aged eleven. Double talipes equino-varus (congenital), relapsing. Patient under treatment in out-door department from infancy, with pretty faithful attendance. Deformity not marked, yet feet by no means straight. Jan. 27, 1888, operative treatment as above. February 21, operation repeated, and on July 14 discharged practically cured. The functions of the feet very good. Walks well without apparatus. Usual preliminary measures adopted.

Case 10. — Male, aged eight. Double talipes equino-varus (congenital). Deformity very marked, yet not extreme. April 4, 1888, operation as above. Two weeks later, pneumonia developed, and patient removed from hospital. Seen during the summer, deformity not having relapsed. To be operated upon in the fall, if necessary.

Case 11. — Male, aged five. Double talipes equino-varus (congenital). Deformity more marked on left side. Has had sev-

eral tenotomies. January 13, operation as above, and fairly good position obtained. March 18, operation repeated; excellent position obtained. May 26, treatment discontinued. September 14, patient discharged with usual precautions.

Case 12. — Male, aged seven. Double talipes equino-varus paralysis, not very pronounced. July 2, 1888, operation as above, except that tenotomy was omitted. September 11, wrench employed again with excellent result. Final result not obtained.

The above list comprises the majority of the cases operated upon, and I regret that I am unable to report final results.

The patients have suffered very little pain after the operation with one exception, and this is the case where failure is recorded. In no instance have I employed the wrench without the administration of ether.

Discussion.

Dr. John Ridlon, of New York, exhibited a wrench which he used for the same purpose; it was modified from a "Utility" wrench. It differed from Thomas's and Gibney's modification, in that the grip was taken by sliding the lower grip-bar towards the upper simply by manual pressure. When in position it was held by a cog-and-spring arrangement which could instantly be released by pressing a trigger. The grip-bars were straight instead of curving towards each other, as in Gibney's instrument. This was an advantage when the instrument was used as an osteoclast in cases of badly united Colles fracture of the radius. As an instrument for cases of club-foot, the author did not think it had any special advantage over Thomas's wrench. The only difficulty with Thomas's wrench was that the monkey-wrench from which it was modified was no longer manufactured and could not be found in the market; consequently it made the instrument very expensive when made singly and by a surgical-instrument maker.

Dr. Bradford, of Boston. — The objection that Dr. Gibney has made to my instrument is a just one, which I have felt myself. When I saw the arrangement of Mr. Thomas, of Liverpool, it seemed to me to be very useful in moderately severe cases. I have found, however, that in the severest cases greater force than is given by the Thomas wrench is needed to rectify the deformity,

particularly in correcting the equinus deformity. I think Dr. Gibney will agree with me in the very case he reported.

Dr. Ridlon. — As regards sloughing, I have not had any. I have not used any padding between the thick rubber tubing which covers the steel fingers of the wrench and the skin. To be sure, I have not used the wrench in very severe cases; but I am inclined to believe that the skin will bear a very great pressure if it be but momentary, and therefore it is of importance that apparatuses of this kind, and osteoclasts, should be so constructed that the grip can be instantly released when the work is done. Dr. Ridard, of Paris, in using the osteoclast, uses several thicknesses of *wet cloth* as padding where pressure is brought to bear over some prominent bony point. This suggestion is offered to those who have caused sloughing by the use of the wrench.

Dr. Gibney. — With reference to what Dr. Ridlon has said about sloughing, I think you can get any amount of pressure without sloughing; if you get a grip and hold on to it, and expect to get much more time and keep the apparatus in place for a minute or a little longer than that, you are apt to get depression of the skin, which results in sloughing. If you apply pressure quickly, this rubber tissue is sufficient to guard against that. The original Thomas apparatus I have myself; he made me a present of it. It is much longer than this one. It is stained somewhat with dirt; hence I brought this one along.

Dr. Bradford. — I have been trying in these severe cases to accomplish correction at one sitting, because it is disagreeable for a child to be subjected to two or three operations. I push the force to its utmost limit, and with the exception of one or two cases, I have succeeded in correcting the deformity. I wish some gentleman would modify my arrangement and simplify it. I have not succeeded in doing so. In regard to padding, I use saddler's felt.

Dr. A. J. Steele. — I have had no experience with the wrench that has been exhibited, though occasionally resorting to mechanical force; but I shall be pleased to test this method hereafter with the hope of accomplishing good. A few years since, I constructed an instrument for mechanically rectifying inveterate club-foot. The idea was old, but I had not seen anything of the sort. It consisted of a steel oblong plate upon which the foot might rest; then by arms screw-pads were attached and made to press upon the ball of the great toe, the os calcis, and head of the astragalus; the child under chloroform, and tendons divided. With these screws I could produce

tremendous force. I had the foot at my mercy, so to speak. I have not been troubled with sloughing, because the pressure is applied for so short a time. The idea is to tear the ligaments, force the foot into proper position, and so retain it by plaster of paris until the parts are in proper relation.

Dr. JAMES E. MOORE, of Minneapolis, Minn. — I think that undoubtedly Dr. Gibney's instrument is a very useful one, although I have had no personal experience with it. The objection I make to it is this: I think the pressure is liable to be applied to a too limited surface. I have improvised such an apparatus as Dr. Steele speaks of, from ideas gained from older apparatus, and have had very satisfactory results in the treatment of my cases.

I apply pressure in such a way that I can increase or diminish it at the inner side of the toe, heel, or at the instep, just as it suits me, whichever is best for the case. I have had no sloughing in any of my cases. I must agree with Dr. Gibney in applying all the force that is necessary at once. It does seem to me that the original idea of Dr. Thomas of reducing deformity a little at a time is like cutting a pig's tail off an inch at a time. We can accomplish reduction of great deformities in two or three months now that in former times took more than as many years, and we get better results, with more comfort to the patient.

Dr. VANCE. — I have had no experience with the twister, but my experience with the application of plaster of paris in cases of club-foot has not been satisfactory. I do not think we have the necessary retentive power in the case of a small child with a plaster of paris dressing, particularly if we put enough material between it and the foot to prevent localized pressure. I can understand how Dr. Gibney's older cases got along so well. The size and better shape of the feet prevented that teasing out which takes place in infants. The feet tease out, whether the muscles are divided or not.

There is one point in the use of plaster of paris I would like to refer to, and that is this: the doctor did not say how far he carried it up the limb. If it is only between the knee and ankle, there would be a tendency for the force to be relieved by the rotation of the leg in the plaster case. I have applied the plaster up to the perineum, having the limb flexed at the knee; in this way we can get much better retention of the foot in calcaneo valgus. The plaster may be made in two sections, the division occurring halfway between the knee and ankle; then rotation of the foot upon the leg can be regulated at will, the sections being held in their new

relationship by bands of adhesive plaster or a new turn of plaster bandages. I fear as a result of this rough treatment, particularly in children who have delicate constitutions, that flat foot might occur. I have observed this in one or two instances where I used my hands as the twister.

Dr. Bradford. — In regard to the plaster of paris, the objection Dr. Vance has raised occurred to me when I first used it; and I think it is a practical one, and one that we see in babies and fat children, and especially in the application of it without tenotomy. Plaster of paris applied above the knee prevents rotation. Wolfe's method of silicate bandages and of plaster of paris for a few days until the silicate has become hard, will be found an efficient and convenient method.

Dr. Lewis Hall Sayre. — I have had no practical experience with the twister of Mr. Thomas and the various modifications presented by Dr. Gibney and Dr. Ridlon. I can see any number of cases in which it may be of great practical value. I think a great many of these deformities can be rectified with it, and I certainly agree with Dr. Bradford and Dr. Gibney as to the immediate reduction of the deformity and the retention of the foot in the improved position with plaster of paris. I have used plaster of paris a great deal; and while the remarks of Dr. Bradford and those of some other gentlemen that spoke are opposed to it, because of its slipping in some young children, I think, with a little care in its application and a little attention to detail, the objections raised could be obviated in fat children with small feet and big legs. I find the best way to put on a plaster bandage is first to overcome the deformity before you undertake to hold it with any sort of apparatus. If you take an ordinary thick stocking that fits the child smoothly and snugly and put it on inside out, and carry it above the knee, as recommended I think by Dr. Vance, you will have little trouble with it; and I find when the deformity is thoroughly reduced by tenotomy or manual force, — and I have generally reduced all mine with manual force and tenotomy without any mechanical apparatus to aid me, —the application of plaster of paris has certainly been a most satisfactory dressing in my hands.

Dr. Whitehead. — It seems to me that this new apparatus that has been exhibited would be very applicable in a certain number of cases.

With regard to the question of club-foot, I have heretofore used the Barwell dressing. During the past month I have had two cases,

one of them a double varus, in which I found satisfaction in the use of this dressing; both of the children were young infants.

I regard tenotomy as a valuable and necessary measure only in those cases in which the tendons are permanently contracted, as usually seen in children in whom the deformity has been neglected, or unsuccessfully treated.

Dr. HODGEN. — What has been said with regard to the wrinkling of the plaster recalls to my mind two accidents that occurred to me in the correction of equinus after tenotomy. In both of these cases the assistant did not flex the foot during the application of the plaster as far as it was intended it should be flexed, and that caused the wrinkling and pressure on the dorsal artery of the foot. As far as the correction of the varus is concerned, I have never had any trouble with the plaster of paris in holding the part in position.

Dr. PACKARD asked how long it would be before the varus is fully corrected.

Dr. GIBNEY. — In speaking of correcting the varus, I did not mean the immediate reduction of the deformity, but that we took the dressing off in a day or two. What I mean by correction of the varus is a permanent correction of it; and as I said before, it sometimes takes six or eight months in keeping up lateral force.

I use plaster of paris in preference to the side splints, adhesive straps, or roller. I know when I put it on it will be there when I see it again, and the mother won't meddle with the dressings. I prefer always to divide the treatment into two stages, — namely, the correction of the varus and correction of the equinus, — and do not accomplish both at the same time or at one sitting.

Dr. STEELE. — On the question raised by Dr. Vance as to how to hold the foot in position, I take a piece of thin board a little larger than the sole of the foot and adapt it to it, using the plaster-of-paris bandage, so that it becomes a part of the foot, and can be manipulated as a handle to force the parts and to so hold them until the plaster-of-paris bandage is carried up over the ankle and leg and hardens. The plaster may be reinforced by a strip of perforated bent tin carried under the sole (board) and up on each side of the leg incorporated into the plaster.

Dr. RYAN. — I desire to say a few words concerning the use of plaster of paris in very young children. The objections made to its use are good ones; but taking it all in all, it seems to me to be the best dressing we can use in the treatment of club-foot, more particularly in that class of cases that come to our dispensaries,

clinics, etc. I have used it to a considerable extent, and have had no trouble from excoriations, and am entirely satisfied with it in this class. Moreover, one has the great satisfaction of knowing the dressing will remain until the case is seen again, — a not undesirable thing in the management of club-foot.

I have not carried the dressing above the knee joint; but the method impresses me as a good one, and I will in future adopt it.

REPORT OF MORTON'S OPERATION FOR THE REDUCTION OF CLUB-FOOT.

BY H. HODGEN, M.D., ST. LOUIS.

Mr. President and Gentlemen: This paper is not intended to be an exhaustive report; simply a history of eight operations for varus by the method of Dr. Morton.

Case 1. A. M., aged five years, Texas. — Double congenital equino-varus. Walks on the outside and dorsum of foot. In walking, the inversion was so great that the feet were lifted one over the other. No treatment for the trouble. September, 1887, crushed the right foot and put in plaster. Oct. 3, 1887, left foot crushed and put in plaster. No reaction followed the operation. Jan. 14, 1888, removed and reapplied plaster to both feet. Position fairly good, but not what it should be. March 10, crushed both feet again; position before they were put in plaster very good. March 11, temperature 98.4°. Some six or seven days after this, had a series of convulsions for three hours; thought to be due to feet. Plasters removed and reapplied. No trouble with feet. Mother thinks that the fever and convulsions were due to chewing-gum which the patient swallowed. April 29, removed plasters and put Hodgen Club-foot Shoes on. Returned to Texas, and at last report was doing well. Could walk for some distance and not get tired. Will say that in this case the equino was corrected after the crushing. This is not the best plan, I am sure.

Case 2. C. D., aged nine years; Arkansas. — Congenital equino-varus. Left foot. Deformity not bad, but the structures all firm and unyielding. At birth both feet were in the position of equino-varus. Both feet operated upon when fourteen months old; a splendid result for the right foot, but the left was not improved. Second operation at the age of four years; the equino partly corrected, but varus not altered. Has worn brace on

this foot ever since. September 30, partly crushed the foot, but found the structures much stronger than the apparatus for crushing. Foot put in plaster. No reaction. October 14, removed plaster; found the foot in fair position. October 12, tenotomy; put in plaster. October 23, crushed and put in plaster. The temperature following this operation reached 100° for four days, but subsided without further trouble. November 4, put fresh plaster on foot and sent home with Hodgen shoe for day use and Shaffer's light night shoe. Plaster was too tight and had to be removed. Kept foot in shoes as well as they could, but not being satisfied returned April 17, 1888. Patient stands squarely on the feet, and the result is good. Patient remained for a month, and at the end of that time the foot was about as good as the other. Have heard from them since, and the foot is reported to be as good as the other. This case proved to my mind that the operation was the proper one for the most desperate as well as the better cases.

Case 3. C. B., aged four years; Illinois. — Double congenital equino-varus. Deformity very marked. November 20, used Morton's apparatus. Tenotomy. Wounded left post-tibial; to control the hemorrhage, used antiseptic compress. Put in plaster. Highest temperature, 99. 1°. Have not seen him since; but his physician wrote he was doing well, and the feet were in good position. This patient was kept long enough for it to be seen there would be no trouble with the wounded artery. For the first eight or ten hours the circulation in the foot was poor, but after this became apparently normal. The compress controlled the bleeding.

Case 4. D. D., aged four years; Missouri. — Congenital equino-varus. Operated upon when four months old. Right foot did very well; but the left relapsed, and while not nearly so bad as at first, was not in good position. Dec. 16, 1887, crushed and put in plaster. Tenotome broken. Highest temperature, 99°. May 2, 1888, removed plaster and put on club-foot shoe. When I last saw patient the foot was in good position.

Case 5. A. K., aged two years; Illinois. — Double congenital equino-varus. Marked deformity. Had walked but little. Tissues very firm. April 8, double tenotomy; put in plaster.

April 12, no rise of temperature and did not complain of pain. May 3, equinos corrected. Crushed feet; put in plaster. May 4, temperature, 99°. May 5, temperature, 98.4°. No pain; returned home. Have heard from patient since, and everything has gone well. They will return as soon as the plaster gets soft, and get club-foot shoes. This is the youngest patient upon whom the apparatus has been used by me.

This is the history of but eight operations for the reduction of club-foot by this method; but I think they have presented a variety of conditions, and prove most conclusively the value of the operation.

Deductions.

1. Tenotomy for equinus should be made first, and the deformity at once reduced.
2. Immediate reduction of the deformity is the proper procedure. Saves time, pain, and the correction is more certain.
3. Can be used in all cases with safety, but has no advantage over hand pressure of the surgeon in young subjects when the tissues are soft.
4. There is no need of preparatory treatment of the tissues by poulticing.
5. The force should be applied inwards, downwards, and slightly forwards until the tissues are felt to give way.
6. Plaster dressing applied with the foot in the position of valgus, and allowed to remain for two months.
7. The bursæ will have nearly disappeared when the cast is removed, and they are not as a rule tender.
8. The use of a club-foot shoe for some time, in which pressure can be made in the direction of the crushing force.
9. A marked rise of temperature is not to be expected; and when this and pain are present we must look to the plaster as the cause in a large percentage of these cases.

In closing, I feel that it is but justice to Dr. Morton to state that the apparatus used by me was a crude one, made from the description kindly furnished me by the doctor, and from my re-

membrance of the one exhibited at our last meeting. I found the upright of no service, and indeed think it is in the way. This may be because I failed to understand its proper use. The apparatus was not used in all cases, but in those in which the deformity could not be properly reduced by the hands. Have used it once since this, but can make no satisfactory report.

TREATMENT OF CLUB-FOOT.

BY E. H. BRADFORD, M.D., BOSTON.

The literature of the treatment of club-foot is, as a rule, that of unvarying success. It is often as brilliant as an advertising sheet, and yet in practice there is no lack of half-cured or relapsed cases, — sufficient evidence that methods of cure are not universally understood. The literature should contain clinical memoranda, including with the successful cases also a record of imperfect results and failures, with, if possible, an investigation of the causes of failure.

Appended to this paper is a table of one hundred and one cases of club-foot, with a record of results and detailed notes of illustrative cases.

A detailed statement of the pathological anatomy of club-foot is unnecessary here, as it has been thoroughly investigated elsewhere, and admits of no dispute. As is well known, there is not only a misplacement of the front of the foot, but also always a distortion of the bones of the foot and shortening of some of the ligaments and soft tissues, including, of course, the tendons. The chief distortion is in the astragalus, the neck and anterior facet being inclined to the side. The scaphoid and the os calcis are slightly altered in shape; the ligaments and tendons are necessarily different in length from the same in a normal foot, as they are attached, and bind the bones in an abnormal position. The extent of this distortion of the astragalus varies, but it is always to be found to a degree.

The treatment of club-foot, therefore, necessarily requires, —

1. A rectification of the misplaced bones.

2. A retention in a normal position until the abnormal facet of the astragalus becomes, under the pressure of new position, normal.

The first of these can be done by mechanical means, stretching or tearing the ligaments and tendons, forcing the foot into shape, or with the help of tenotomy. It may be done gradually or quickly.

The second is purely a mechanical problem, and the retentive appliance should be worn for a longer or shorter time, according to the size of the distorted bone and the amount of the distortion.

But although there can be no dispute as to the above aphorisms, an examination of the current literature of the subject shows much diversity of opinion as to methods. In some clinics purely mechanical means are used, and in some entirely operative; in some tenotomy only, with delayed rectification, and in others immediate rectification, with or without tenotomy or fasciotomy; in some the radical measures of osteotomy and excision are denounced as unnecessary, and in others recommended, even in infants. And this, too, although there is unanimity of opinion as to the pathological anatomy of the deformity. This distortion is plain; but there is much uncertainty as to the proper method of attack.

The following different questions in regard to treatment are at present unsettled: —

1. In what cases is it advisable to correct and treat by mechanical means alone, without the help of any operative interference, even tenotomy?

2. When is tenotomy advisable?

3. Can severe cases be entirely corrected and permanently cured without tarsal resection or osteotomy?

4. Is tarsal resection or osteotomy a justifiable operation?

The accompanying tables of cases will be used in the attempt to substantiate the following statements: —

1. That the cases of infantile club-foot can, as a rule, be thoroughly and efficiently treated without tenotomy by mechanical correction and mechanical retention alone. Tenotomy, however, is an aid even in infantile cases.

2. That in older cases tenotomy aids the correction, and is not injurious in the permanent result.

3. That, as a rule, resistant cases of the severest type can be corrected without tarsal osteotomy, by forcible rectification.

4. That in exceptional cases of resistant club-foot, tarsal osteotomy may be needed for perfect rectification, and is not only justified, but may be indicated in exceptional instances.

Table of Cases. — The accompanying tables of ninety-nine cases include all the cases of congenital talipes equino-varus which have come under the writer's care; they are all cases of congenital deformity of the usual severity, and range from the age of a few weeks to that of eighteen years at the time of commencement of treatment. The cases are taken from all classes, and are in no way selected cases. Almost all known methods have been employed, and tried, it is thought, thoroughly. Many of the cases have been a long time under observation, — the longest ten years, — and the permanency of the cure can be, in most instances, determined. A comparison in the table of the ages of the patient when first seen and when last seen, indicate the length of time the child remained under observation.

In the tables the results are classified as follows: —

1. Perfect.
2. Good.
3. Satisfactory.
4. Imperfect.

By perfect, a result is meant whereby the patient not only is able to stand entirely flat upon the sole of the foot, with the leg at right angles with the floor, but where there is enough flexion at the ankle joint to enable the leg to be bent forward without causing an elevation of the heel or rolling of the foot, or to allow the child to walk on its heel.

By good, is meant that the child walks with the sole entirely flat upon the ground, without twisting or curling the foot and without any appliance, but is unable to flex the ankle to an extent that the leg can come forward of a perpendicular to the floor without raising the heel or twisting the foot.

By satisfactory, is meant that no twist or abnormality in the foot can be seen with the shoe on, but the bared foot shows that the outer edge of the sole (not the side of the foot) bears a greater part of the weight than it should, due to a slight twist in the foot. Cases still needing walking-appliance, owing to remaining muscular weakness, are classed as good, if the correction is perfect.

By imperfect, is meant either that the heel does not strike well on the floor in walking, — that is, there remains some of an equinus deformity, — or there is a twist in the foot which needs a mechanical support to prevent the foot from twisting in walk-

ing, — some weight is borne on the ball of the great toe, but not the required amount. In a few cases no appliance is able to prevent the foot from twisting; so that pressure in walking falls not only on the outer edge of the sole but on the side of the foot, no weight is borne on the ball of the great toe, and the heel does not strike the ground in walking. The details of these cases will be given.

In the tables the cases are grouped under the following heads:

1. Cases treated without tenotomy.
2. Infantile cases treated with the help of tenotomy.
3. Walking cases in children (between two and five years old).
4. Resistant cases.

The latter class ranges from five years to eighteen, and includes the relapsed and so-called inveterate cases.

TABLE I.

Cases treated without Tenotomy.

No.	Name.	Age when first seen.	Single or Double.	Result.	Age when last seen.
1	E.[1]	5 months	S.	Perfect	4 years
2	D.	4 "	D.	Perfect	11 "
3	Smith	2 "	S.	Perfect	6 "
4	Graham[2]	6 "	S.	Perfect	3 "
5	Estabrook[3]	3 "	S.	Satisfactory	6 months
6	Jaeger	7 weeks	S.	Perfect	3 years
7	Proudfoot	2 months	S.	Perfect	3 "
8	Richardson	4 weeks	S.	Perfect	2 "
9	Hanna	4 years	S.	Perfect	5 "
10	B.	2 "	S.	Good	6 "
11	Merriam[4]	5 "	S.	Unsatisfactory	8 "
12	Pinkham	1 "	S.	Perfect	2 "
13	Rogers[5]	3 months	S.	Satisfactory	4 months
14	Adams[5]	6 "	S.	Satisfactory	7 "
15	Barnard[5]	6 "	D.	Satisfactory	7 "
16	Carberry[5]	8 "	D.	Satisfactory	9 "

Omitting 5 cases (7 feet) still under treatment, this table represents 12 feet. Results as follows: —

Perfect	10
Good	1
Satisfactory	1

[1] Died at four, of croup.

[2] Tenotomy imperfect; correction previous to commencement of treatment.

[3] Died at six months.

[4] Treated by mother, as infant, by manual correction. Operation declined. Under treatment.

[5] Still under treatment.

TABLE II.

Infants in Arms, treated with the Aid of Tenotomy.

No.	Name.	Age when first seen.	Single or Double.	Result.	Age when last seen.
1	Warren[1] . . .	3 months	D.	Satisfactory	6 years
2	Sparks	8 "	S.	Perfect	8 "
3	Thurlow . . .	1 "	D.	Satisfactory, R. Imperfect, L.	4 "
4	Porter[2] . . .	3 "	S.	Satisfactory	6 months
5	Schindler . . .	6 "	S.	Good	4 years
6	Kelly, J. . . .	18 "	D.	Satisfactory	6 "
7	Kelly, W.. . .	3 "	D.	Perfect	3 "
8	Sands	3 "	D.	Perfect	3 "
9	Bartlett . . .	6 "	S.	Good	2 "
10	Robinson . . .	8 "	S.	Satisfactory	2 "
11	Eastman . . .	12 "	S.	Perfect	2 "
12	Joubert . . .	12 "	S.	Good	1½ "
13	Seiler[3] . . .	7 "	D.	Good	2 "
14	Emmons . . .	20 "	S.	Perfect	2 "
15	Sawyer . . .	6 "	S.	Good	2 "
16	Brooks[4] . . .	18 "	S.	Satisfactory	
17	Murphy . . .	4 "	S.	Satisfactory	14 months
18	Ferguson . . .	12 "	S.	Good	3 years
19	Cunningham . .	3 "	S.	Satisfactory	3½ "
20	Wilson	3 "	D.	Good Imperfect	6 "
21	Bütner	12 "	S.	Satisfactory	3 "
22	O'Neil	3 "	S.	Satisfactory	6 months
23	W.	3 "	S.	Imperfect	5 years
24	B. C. H.[4] . . .	12 "	S.	Good	1½ "
25	Lester Allen[5] .	6 "	S.	Good	

Omitting 3 cases (4 feet) still under treatment, this table includes 29 feet. Results as follows: —

Perfect	7
Good	8
Satisfactory	9
Imperfect	2
Not known	3

[1] After-treatment neglected until two years. Second operation at four. Slight recontraction of tendo achillis at six. Second operation necessary.

[2] Ultimate result not known.

[3] Relapse in one foot. Second operation.

[4] Further result not known.

[5] Still under treatment.

TABLE III.

Walking Cases, between Two and Five Years of Age.

No.	Name.	Age when first seen.	Single or Double.	Result.	Age when last seen.
1	Wadleigh . . .	2 years	S	Perfect	6 years
2	Kinny [1] . . .	2 "	S.	Good	6 "
3	Feeley	2 "	D.	Good	5 "
4	Mann	2 "	D.	Good, R. Satisfactory, L.	6 "
5	Emerson . . .	2 "	D.	Satisfactory	3 "
6	Cotter	2 "	S.	Not known	? "
7	Dunn	2 "	S.	Not known	
8	Burns	2 "	S.	Perfect	4 "
9	Hirsch [2] . . .	2 "	S.	Satisfactory	4 "
10	Williams [3]. . .	2½ "	D.	Good Imperfect	6 "
11	Scannell [4] . . .	2½ "	D.	Imperfect	4 "
12	Kimball . . .	3 "	S.	Satisfactory	4 "
13	Gibson	3 "	S.	Good	3½ "
14	Gould	3 "	D.	Satisfactory	5 "
15	Kimball . . .	3 "	S.	Good	5 "
16	Guakin . . .	4 "	D.	Not known	
17	Bishop	4 "	S.	Satisfactory	6 "
18	Minard . . .	4 "	S.	Good	6 "
19	Scribner . . .	4 "	S.	Good	6 "
20	Mahoney . . .	4 "	D.	Imperfect	7 "
21	Walsh [5] . . .	4 "	S.	Good	4½ "
22	Harrington . .	4 "	S.	Not known	
23	W. S. Wales [6] .	4 "	D.	Good	4½ "
24	Mich. Coleman [6]	4 "	S.	Good	4½ "
25	John Collins [6] .	4 "	S.	Good	4 "

Omitting 7 cases (9 feet) under treatment and where results are not known, this table represents 25 feet. Results as follows: —

Perfect	2
Good	10
Satisfactory	8
Imperfect	5

[1] Slight recontraction. Second operation at five.
[2] Second operation. Died at four.
[3] At four, slight recontraction. Second operation.
[4] Vide Appendix.
[5] Osteotomy. Slight retraction of tendo achillis. Vide Appendix.
[6] Still under treatment.

TABLE IV.

Resistant Cases, older than Five Years.

No.	Name.	Age when first seen.	Single or Double.	Result.	Age when last seen.
1	Horihan . . .	5 years	D.	Perfect	9 years
2	Woodworth . .	5 "	S.	Perfect	8 "
3	Dana	5 "	D.	Good	6 "
4	Williams . . .	5 "	D.	Good	10 "
5	Flynn	5 "	S.	Imperfect	7 "
6	Stone	5 "	S.	Perfect	6 "
7	Meehan . . .	5 "	S.	Not known	
8	O'Donnell . . .	5 "	S.	Not known	
9	Stevens . . .	5 "	S.	Perfect	6 "
10	McKee	5 "	S.	Imperfect	7 "
11	Atkinson . . .	6 "	S.	Not known	
12	Devere	6 "	S.	Good	7½ "
13	Edmunds[1] . .	6 "	D.	Perfect	8 "
14	Mitchell . . .	6 "	D.	Perfect, R. Satisfactory, L.	8 "
15	Poland	6 "	S.	Good	8 "
16	Nelson	6 "	S.	Perfect	8 "
17	Waite	7 "	D.	Imperfect	10 "
18	O'Keefe[2] . . .	7 "	D.	Satisfactory Imperfect	9 "
19	Darby[3] . . .	7 "	S.	Perfect	7½ "
20	McKay . . .	8 "	S.	Perfect	13 "
21	McDonald . .	8 "	S.	Good	10 "
22	Hogan	9½ "	D.	Perfect	10½ "
23	S. W.	10 "	D.	Perfect	10½ "
24	Gray	11 "	S.	Good	13 "
25	Hobbs	11 "	D.	Satisfactory	13 "
26	Wood[4]	12 "	S.	Satisfactory	13 "
27	Fitzgerald[4] . .	12 "	D.	Perfect	20 "
28	Sweeney . . .	15 "	S.	Perfect	17 "
29	Ryerson . . .	15 "	S.	Perfect	15½ "
30	Roof	18 "	S.	Perfect	20 "
31	Gale	5 "	D.	Satisfactory	6 "
32	Daniels[5] . . .	7 "	D.	Imperfect, L. Perfect, R.	9 "
33	A. D. Silverman[6]	11 "	S.	Good	11¼ "

Omitting 3 cases (3 feet) result not known, and 2 cases (3 feet) still under observation, this table represents 41 feet. Results as follows: —

Perfect	20
Good	8
Satisfactory	7
Imperfect	6

[1] Treatment for a long time. Third operation. Tenotomy at seven.
[2] Second operation at eight.
[3] Osteotomy. [4] Tarsal excision. [5] Died at nine. [6] Open incision.

DETAILED NOTES OF ILLUSTRATIVE CASES.

D., Table I., Case 2, was a double deformity of the usual severity, which came under treatment at an early stage. The left foot was the most resistant. Some trouble was encountered on account of a troublesome eczema under the bandages. Correction was therefore delayed; but by the time the child began to walk the feet were entirely corrected and overcorrected. Walking-appliances were worn a year. The accompanying photographs show the present condition, at the age of eleven. Tenotomy was not done, and the

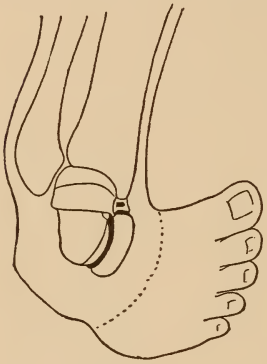

FIG. 13.

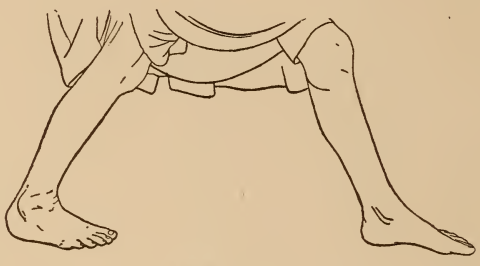

FIG. 15.

FIG. 14.

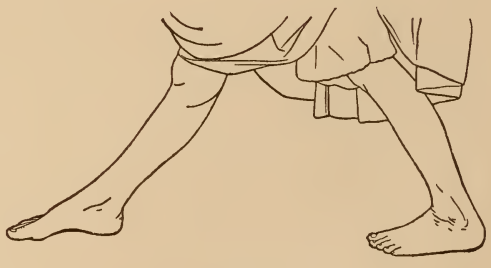

FIG. 16.

case illustrates the fact of perfect and permanent correction without tenotomy. No cast was taken of the foot at the commencement of treatment, but the distortion was of the severity indicated by the accompanying drawing from a similar case. The photographs (side view) indicate the length of possible step, keeping the heel to the ground, and the corresponding amount of play at the ankle. The case illustrates the permanency of a cure of club-foot. (Figs. 13, 14, 15, 16.)

E., Table I., Case 1. — Case of ordinary infantile club-foot successfully treated without tenotomy. Death occurred at the age of three, from croup; and after death, on examination, it was found that the *post mortem* resistance was much greater on the affected side than on the normal side. This had been so, in a measure, before death.

Case 11, Table I. The case was treated at home by the mother without operation and without tenotomy. The child's foot was held by the mother and a nurse for nearly three months; and the deformity, said to have been the usual one of infantile club-foot, was nearly corrected. At the time of presentation of the child to the writer, at the age of four, slight equinus deformity remained. Tenotomy was advised, but declined; and mechanical treatment attempted, but without thoroughness. At the age of seven the contraction of the tendo achillis has increased, that of the plantar fascia has developed, and the foot is not planted well on the floor, and is twisted, and rolls in walking. When an appliance is worn the foot is nearly corrected, but not entirely.[1] The case illustrates a relapse from nearly perfect correction without tenotomy, correction being made in an unusual way.

Sands, Table II., Case 8. — Double infantile case corrected by tenotomy and fixation bandages of plaster of paris. Some ligamentous resistance was encountered in the left foot, and the fixation bandages were worn a long time, being renewed frequently. The muscles of the leg have remained smaller than normal, and a slight tendency to valgus persists. It is thought that the constant and prolonged use of bandages was injurious to the muscles. The deformity is overcorrected, and a tendency to a valgus deformity from weak muscles remains.

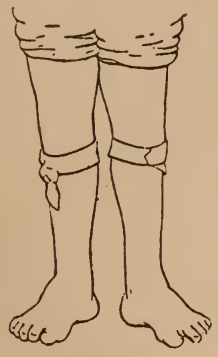

Fig. 17.

Result of mechanical treatment — some equinus deformity — left.

Edmonds, Table IV., Case 13. — This case was nearly corrected by bandaging and appliances under the direction of an advertising doctor. Correction was not complete at the age of five. The twisting and rotation of the foot had been corrected, but some equinus deformity remained. By means of appliances this was overcome, but complete correction of the equinus was not gained. Two years later a tendency to relapse was noticed, and tenotomy was done, and cure accomplished. (Fig. 17.)

Scannell, Case 11, Table III., presents a result similar to that of Case 2, Table VIII., but to a much greater degree. In this case a marked valgus resulted from the overcorrection of varus, and demanding much care for the treatment of valgus. The case was an ordinary one of walking club-foot, and corrected by operation. The corrective varus walking-shoe was worn too long, the child not being brought for examination for nearly a year after its application. The patient is wearing an appliance for the correction of the valgus.

[1] Tenotomy has been recently done with satisfactory result in this case.

Wilson, Case 20, Table II. — Double club-foot treated by tenotomy when an infant. At the age of eight, with the feet bared, there is noticed a tendency to roll the foot if a long step is taken. It is more noticeable in one foot than in the other. Appliances are not needed, but the shoe is worn more on the outer side than on the inner; the tendo achillis is not free enough to allow extension of the foot above the right angle. This was one of the earlier cases, and overcorrection was not pushed to its proper amount.

Cases 1 and 23, Table II. — In Case 1 the patient was not thoroughly attended to after the operation, through neglect of parents. A satisfactory result was gained by a second operation some years later, but the latter was delayed too long to give perfect results.

In Case 23 no second operation was attempted, as the patient passed out of treatment and was neglected by the parents.

Sparks, Case 2, Table II. — An infantile case which relapsed somewhat in the tendo achillis at the age of four, requiring a second tenotomy, after which the result was perfect and has remained so for two years.

Cases 3 and 6, Table II., show each a lack of perfection in one foot from lack in overcorrection at the time of the operation. In Thurlow this occasioned a relapse in one foot, requiring a second operation, which is to be done. The same may be said of Case 10, Table III., and of Case 18, Table IV.

Fig. 18.

Fig. 19.

Fig. 20.

Case 20, Table IV., is interesting as a perfect result obtained, in an extremely resistant case, by forcible correction. The foot has remained perfect for several years, and the patient is now nearly full-grown. (Figs. 18, 19, 20.)

Cases 5, 17, 32, Table IV., and Case 20, Table III., were early cases of forcible correction, before the method was perfected. Imperfect results were

Fig. 21.

From photograph.
September, 1883.

Fig. 22.

From photograph.
Jan. 1, 1884.

Fig. 23.

From photograph.
Jan. 1, 1884. Wearing appliance.

Table IV., Case 32.

obtained in the first two cases from imperfect fixation after correction, allowing twisting of the foot. In the second the foot was not perfectly corrected.

In Case 5 an aneurism followed free tenotomy, and required ligation. It was found to have followed a pin-hole wound of the artery from the tenotome. This probably would not have occurred if pressure from bandaging had not been removed within two days of the operation. No evil result followed.

Case 14, Table IV. — Perfect correction in one foot, imperfect in the other. On the second foot complete correction was not gained on the application of force. A slight twist of the foot remained, requiring an apparatus to keep the foot in proper position. It would appear that with the aid of an osteotomy of the astragalus complete correction could have been obtained in this case, but the deformity was so slight that osteotomy was not urged.

Case 29, Table IV. — This case illustrates the difficulty of complete correction of club-foot without tenotomy. The boy had had careful and thorough mechanical treatment for many years, with the object of stretching the tendo achillis; a contraction, however, of the plantar fascia and of the tendo achillis remained sufficient to maintain a marked deformity. With the help of tenotomy and forcible manipulation and fixation, the foot was corrected and remained so permanently. A walking-appliance was needed for six months after the operation, but has since been discarded.

Case 12, Table IV. — This case is interesting on account of the occurrence of a large slough, during the treatment, at the inner and under side of the great toe. After correction and fixation by plaster bandage, the child was taken with chicken-pox quite severely. The plaster bandage was not re-

moved for some little time, and quite severe sloughs were found occasioned by the edge of the plaster bandage. The plaster bandage was then removed, and an appliance similar to that of Beely was used. A fortnight was required for the healing of the slough, which however took place perfectly, and no permanent inconvenience or disability was occasioned. The correction is now perfect, and the child walks well without an appliance, but has a slight tendency to toe in, owing to muscular weakness, if the walking-shoe is left off continuously.

Case 4, Table III. — This case illustrates a relaxed condition of the knee. Although the feet were entirely correct, yet a tendency to the inversion of the foot in walking remains. This, on examination, is found to be due to a rotation of the tibia on the femur at the knee joint. This necessitates the use of a walking-appliance.

Case 28, Table IV. — This case illustrates the complete and perfect correction of a resistant club-foot in a boy of fifteen, by the use of force under anæsthesia, at one sitting. (Figs. 24, 25, 26.)

FIG. 24. Drawn from cast. August, 1883.

FIG. 25. From photograph. Jan. 1, 1884.

FIG. 26. From imprint of sole of foot. Jan. 1, 1884.

Case 30, Table IV. — A case of complete correction, by the use of force, of a severe deformity in a woman of eighteen. Two sittings were required. (Figs. 27, 28, 29.)

Case 19, Table IV. — An osteotomy of the neck of the astragalus was done with excellent result. An incision was made over the internal malleolus downward and forward along the line of the first metacarpal. The plantar fascia was thoroughly divided, and a chisel inserted into the neck of the astragalus just above the scaphoid, which, in its distorted position, nearly covered it. The scaphoid-astragaloid articulation was opened unavoidably by the chisel. The neck of the astragalus was divided nearly through, and

the foot twisted forcibly, and the rest of the neck fractured. The tendo achillis was then divided subcutaneously. Aseptic dressings were applied to the wound, and the foot held in a corrected position by means of a plaster-of-paris bandage. This was removed at the end of six weeks, and no further appliance has been used. The varus deformity is entirely removed, but there is a slight valgus deformity to be seen on inspection of the bare foot, the internal malleolus being somewhat prominent. No discomfort or disability follows.

Fig. 27.

Fig. 28.

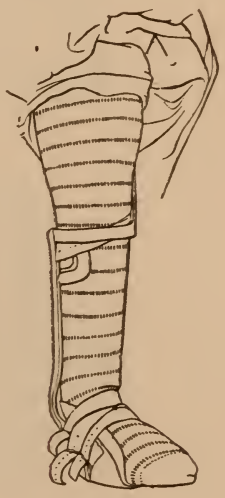

Fig. 29.

A similar operation was done in Case 21, Table III.; but in a child as young, namely four years, such an operation seems unnecessary, for the neck of the astragalus seems to be largely cartilaginous and no better result. The operation was done with the hope of making the foot treatment with apparatus unnecessary. A fair result was obtained, but no better than is obtained without osteotomy.

Open Incision. — Open incision was performed in some cases, and was found to be a help. The advantage of this procedure over subcutaneous tenotomy followed by thorough stretching does not appear to be as great as

would be inferred from the cases reported of this method; but where thorough division by a tenotome is not effected, or where the foot is not forcibly corrected, open incision is decidedly a help.

Two cases of wedge-shaped resection by the writer have already been published by the "Boston Medical and Surgical Journal," Sept. 15, 1881. The result is indicated by the accompanying picture.

FIG. 30.

Nos. 2 and 4 show the foot before, Nos. 1 and 3 after, operation.

One patient was heard of five years after the operation, and was able to walk fifteen or twenty miles without discomfort. The foot had remained in excellent position.

DETAILS : METHODS OF TREATMENT.

The success of treatment in correcting club-foot depends chiefly on thoroughness in detail, — a detail tedious in description, but essential in practice, — and an important part of this detail is the

Choice and Application of Appliances.[1]

Appliances in the treatment of club-foot are for two purposes, —

1. The *correction* of the deformity ; that is, correcting-appliances.

[1] As an economy of space, only the appliances preferred by the writer are mentioned in detail. It is not assumed that other means will not give equally good results, but the object of the present paper is to record personal results.

2. The *retention* of the corrected foot; that is, *retention* or *walking appliances.*

The latter are designed for the purpose of holding the foot in a normal position until all possibility of relapse is passed. Both should be as simple as possible, and should cause as little discomfort as is practicable. The latter should not interfere with locomotion, should be such as can be readily cared for, and, not be unsightly.

Correcting-Appliance. — For correction to be used chiefly in infantile cases, an appliance indicated in the accompanying diagram will be found of great use. It is slightly modified from that used by Beely, of Berlin. It has been used also in the correction of older cases, and can be used in children able to walk.

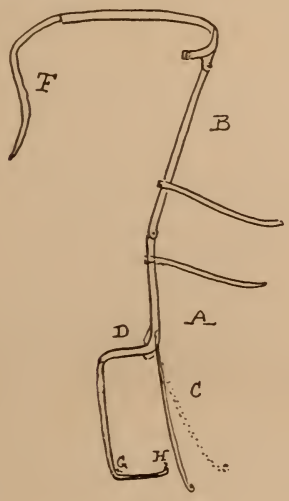

Fig. 31.

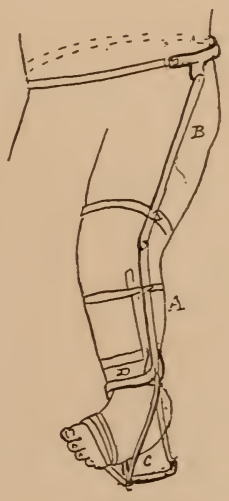

Fig. 32.

Two steel strips, of a strength varying according to the case, are cut of proper length and connected by an ordinary joint allowing free motion. The upper end of B is connected with a bent strip of tempered steel long enough to half encircle the patient's pelvis, — a leather strip F completing the circle. The lower end of A is bent so as to pass under the foot, and has two buckles G H, to receive adhesive plasters on the patient's leg, used for the purpose of keeping the heel well into the appliance. A cross steel strip D, padded, passes in front of the leg above the ankle, and with a strap which goes behind holds the leg from slipping forward or backward. A steel rod C projects to the outer side of the foot. It should be strong enough to stand ordinary strain, but soft-tempered and capable of being bent by a wrench; it furnishes the point from which a pull upon the deformity can be made. A small padded plate I protects the pressure which falls upon the side of the astragalus and os calcis.

The limb can in this way be firmly held in the appliance. The child cannot kick the appliance off, and there is no pressure on the dorsum of the foot to cause pain or sloughs. The appliance is light and is not expensive.

The pull upon the foot is effected by means of a strip or strips of adhesive plaster wound about the foot at the level of the ball of the toes, the free end being long enough to reach the end of the arm C, which can, if desired, be furnished with a buckle, into which the webbing sewn to the end of the plaster can be buckled, or the plaster alone may be wound over the end of the steel rod. If it is desired to furnish elastic tension, elastic webbing can be used; but a continued pull, increased by tightening as the deformity is corrected, will be found satisfactory.

To protect the inside of the great toe from being cut by the pulling adhesive plaster, it can be covered by a strip of smooth leather; and to prevent the adhesive plaster from slipping back, a second strip of plaster can be wound close to the first on the proximal side of the foot.

The side arm C is to be bent as the foot is corrected, the end being placed at the point from which it is desired that the pull should come. If desired, the arm C can be connected with the upright A by means of a double screw joint, so that motion and direction of the arm can be regulated by key. This, however, increases the expense of the appliance without adding to the efficiency. Thorough abduction of the foot should precede elevation or correction of the rotation. Instead of the plasters pulling upon the foot, bandages can be used, bandaging the foot to the arm C. If holes are cut in the stocking and shoe in such a way that the free ends of an adhesive plaster may pass through, the appliance can be used with the patient wearing both shoes and stockings. The writer has, however, used the appliance chiefly for children in arms.

The efficacy of the appliance depends chiefly on the handiness used in applying it. No especial skill is required to tighten the straps; and this can easily be left to the nurse, with the direction that the side straps should be kept as tight as possible. The adhesive plaster should be changed every three or four days, and this can be done by the nurse without difficulty. Some skill is required in designing and fitting the appliance, it being essential that the foot and leg are well held in it, and that the steel is strong enough.

Walking-Appliance: Retention Appliances. — The well-known Taylor varus shoe meets excellently the requirements of a walking-appliance. It can be made thoroughly efficient; it is light and not cumbersome; it does not require special skill in daily application; it does not in any way interfere with locomotion, and allows motion of the foot in desired directions. It can be worn under the shoe and is not unsightly, and can therefore be worn for years, if necessary.

Figs. 33, 34, and 35 illustrate.

If the heel is inclined to draw up, it can be kept down without pressure on the dorsum of the foot by means of adhesive plaster. If the upper part of

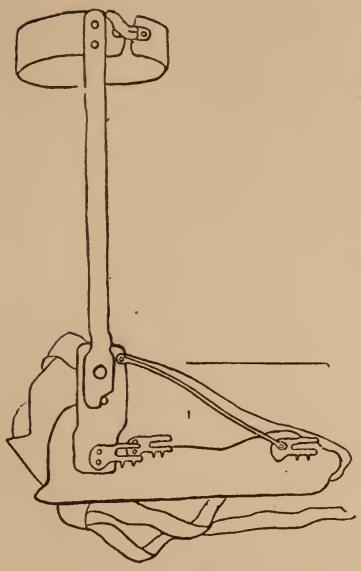

Fig. 33.

Fig. 34.

Fig. 35.

the upright twists about the leg, this can be prevented by carrying the upright above the knee, jointing it above the knee and carrying it around the waist.[1]

Tenotomy. — There is little to be said in regard to tenotomy beyond what is found in the text-books on the subject. The division of the ligaments, as described by Mr. Parker, is of assistance. It is, however, impossible with a tenotome to divide all ligaments in inveterate cases, and much has to be left to mechanical or forcible stretching.

Fixation Bandage. — Of all methods of fixation that of Wolff will be found the most convenient. It consists of the use of silicate of potash bandages to the corrected foot, which should be well protected with sheet wadding. Over this plaster-of-paris bandages are wound. These latter become hard, if good plaster of paris is used, in five minutes. The plaster-of-paris shell can be removed in three or four days, when the silicate bandages will be found hard. This can be worn as long as a fixation is required, or can be renewed.[2]

In applying the bandages it is of course important that the foot should be held in a corrected position, or an overcorrected position, until the plaster becomes hard, as no further correction can take place under the bandage. In the majority of cases perfect correction or overcorrection is possible, and the foot can be held in proper position for the application of the fixation bandages, without much force. The bandages should be carried above the knee to the thigh, to prevent the leg from twisting inside of the plaster bandage.

[1] Dr. C. F. Taylor, of New York, has efficiently used this appliance as a correcting-appliance. I have not been able to use it for this purpose in cases of congenital deformity, though I have in some cases of acquired deformity.

[2] Wolff uses the silicate bandage as a walking-appliance, but it is manifestly more cumbersome and unsightly, and therefore less useful than the Taylor varus shoe.

In resistant cases, however, considerable force is necessary; and to obtain this with certainty the foot can be held in the following way until the plaster-of-paris bandages have become perfectly hard.

There are certain disadvantages in this mode of fixing the feet; notably, the fact that the foot is covered, and that the appliance is not readily removed. This is the price which is paid for more thorough fixation in a more fully corrected position, for greater comfort on the part of the patient; for the bandage, adapting itself to the irregularities of the foot, causes no point pressure. The danger from sloughs is slight, if proper care is used. When they occur they will be found on the inner side of the great toe, if the edge of the bandage presses there, if the bandage be carried beyond the toe, and the toes be not crowded together. Ordinarily sloughs are not to be feared; if they occur they are slight and not of importance, though in one case, where measles and chicken-pox followed immediately after the operation for correction, a large slough on the inner side of the toe was formed at the edge of the bandage, which had not been removed. This, however, readily healed, and occasioned no further trouble. Where sloughs occur, a modification of Beely's correcting-appliance can be substituted for the silicate. The pain following this method of fixation is usually slight; but in resistant cases the pain, in the nights immediately following the operation, may be severe, like that of a tight shoe. Opiates are needed for a few nights. Severe continual pain indicates a slough.

Immediate and Forcible Rectification. — The objections to immediate rectification of club-foot after tenotomy are theoretical, no practical ill result having been known to follow; and the great advantage to the patient is given of painless correction and much more speedy cure.

An anæsthetic is necessary, and the foot should be thoroughly manipulated, and such soft tissues and ligaments as are not divided by the tenotome should be thoroughly stretched. It is manifest that if it is expected in gradual correction that tissues are to be stretched by a mechanical force in a correcting club-foot shoe, the same tissues can be more rapidly stretched by a greater force; and if an anæsthetic is used the patient is spared pain and loss of time. The injury done to the foot is not greater than that of a severe sprain, if as great.

In a large majority of cases manual rectification will bring the foot into position, and it is to be held so by means of fixation bandages, already described. In some instances a great deal of force is necessary to stretch the ligament binding the tarsal bones together, so that complete correction can take place. Repeated etherizations are to be avoided, if possible; and the use of mechanical force, as in osteoclasis, will be found an assistance.

The use of manual force is often inadequate. Mechanical force, as was demonstrated by Dr. Thomas Morton, of Philadelphia, can with safety be applied, and enough force used to overcorrect most resistant cases.

The accompanying diagram illustrates the arrangement which will be found efficacious in these cases. It has the disadvantage of not being as

simple as could be desired; but its hold upon the foot and the possibility of applying pressure directly and exactly, are decided advantages.

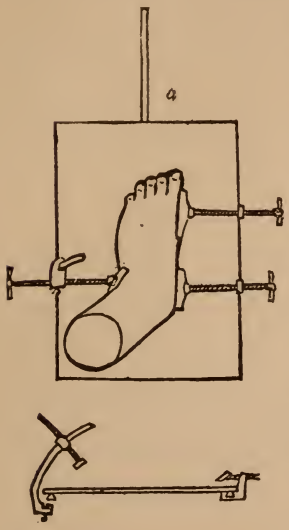

Fig. 36.

Open Incision. — The advantages of an open incision on the inner (concave) side of the distorted foot are that the possibility of overlooking contracted tissues that sometimes escape the tenotome is avoided; but with care and persistency the tenotome can divide with thoroughness everything within the reach of the knife, and there is some advantage in sparing the skin, which can usually be stretched, in that a scar is avoided. In cases with severe bony deformity, simple open incision without osteotomy will not be sufficient.

Cuneiform Osteotomy: Tarsal Resection. — Any one who has performed cuneiform tarsal resection will admit that a great deal of bone is removed unnecessarily. The same is true of ablation of the astragalus. Excellent results, however, are gained by this method, and the danger of the procedure is not very great.

A dissection of a club-foot demonstrates that the obstacles to correction are chiefly in a part of the astragalus, and in the tarsal ligaments which hold the tarsal bones in an abnormal position. Wedge-shaped tarsal resection sacrifices a large part of the tarsus, which might be saved if methods attacking more directly the distorted bone are used.

Fig. 37.

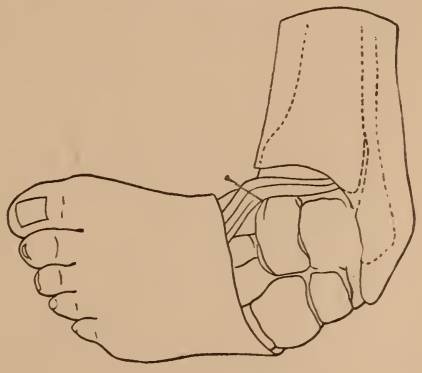

Fig. 38.

Astragaloid Osteotomy. — An examination of the anatomy of resistant club-foot shows, as is indicated in the accompanying picture, that the facet of the astragalus in the astragalo-scaphoid articulation is on the side instead

of in front. There is also some obliquity of the neck of the astragalus. If this obstruction of the bone can be corrected and the front of the foot brought into place, there would be no tendency to relapse.

FIG. 39. Table IV., Case 2. FIG. 40.

Before treatment. Aug. 10, 1882. After treatment. Oct. 4. 1882.

It is essential, in every inveterate case of club-foot, that if the foot is to be unfolded, the shortened tissues in the arch of the foot and in the inner side of the foot be stretched, torn, or divided. This can be done safely by means of tenotomy, forcible stretching, or open incision; but the deformity of the astragalus still remains. In a great majority of cases, if the deformity is rectified and the foot held a sufficient time in the proper position, and a proper

FIG. 41. Table IV., Case 25. FIG. 42.

Before treatment. After treatment.

walking-shoe used for a year, a new facet of the astragalus will be formed and a cure effected. In a few cases this is not the case, and in such instances osteotomy of the neck of the astragalus suggests itself as a suitable operation.

The procedure will not be found a difficult one. Tenotomy and division of the fascia and ligaments should be done, and the foot stretched and manipulated into as nearly a normal position as possible.

An incision through the skin is made from the tip of the malleolus to the inner side of the head of the first metatarsal, which will be found in severe cases close to the malleolus. The incision is close to and nearly parallel to the tibialis anticus tendon, and in the direction of the metatarsal. The incision should be made clear to the bone, and the foot straightened, as the metacarpal bone is separated from the malleolus. The scaphoid will

FIG. 43. Table IV., Case 21. FIG. 44.

Before treatment. After treatment.

be seen before the astragalus is encountered, if the deformity is great, and it will be first within the reach of the knife in all cases. If the foot is still further stretched, the scaphoid begins to uncover the side of the astragalus, and the neck of the astragalus is seen; a small osteotome is entered and placed upon the neck of the astragalus, to the distal side of the scaphoid articulation, and as in the McEwen operation, the neck of the astragalus divided or nearly divided. The foot is then forcibly straightened, and the neck of the astragalus unchiselled is fractured. The result is similar to that in McEwen's operation for knock-knee, and the distortion at the neck of the astragalus is removed. It is manifest the line of section of the bone at the neck of the astragalus should be transverse to the axis of the bone, and at such a plane that when the equinus deformity is corrected, the resulting gap at the section should not be greater than necessary. Strict asepsis is essential. The foot should be fixed in a corrected position.

The number of cases in which this procedure is needed will be found to be very few. In the cases in which it was used it was extremely successful. Vide Tables.

Generalizations.

The treatment of club-foot may be briefly described as the rectification of the foot and retaining it in a normal position as long as there is any tendency toward a return to the distortion. It therefore consists of methods of (1) correction; (2) retention. The correction can be mechanical or operative. If the latter, the foot is to be fixed until the effects of the operation have passed, and the incision by tenotomy healed. The retention appliance can then be used.

The advantages of the purely mechanical or non-operative treatment are manifest in suitable cases. It is less repugnant to parents, provided that it is no less efficient, and not more trying to patients if properly carried out. In infantile cases it does not, as a rule, demand an unnecessary waste of time in correction, for correction can be accomplished before the patient is able to walk.

In older cases purely mechanical treatment demands a great amount of time in correction, in most instances, which could be saved by tenotomy. In resistant cases operative interference is necessary.

Tenotomy without the aid of thorough mechanical treatment is evidently irrational and useless.

It has not appeared that any less perfect or more perfect foot results from mechanical than from operative correction in infantile cases. (Vide cases.)

There can be no doubt that perfect and complete and permanent correction can be accomplished without tenotomy; but it cannot be said that tenotomy offers any disadvantages, and the injuries attributed to tenotomy seem fairly attributable to imperfect correction or faulty appliances.

Tenotomy should be thorough, and should, if necessary, be aided by division of the ligaments, and by immediate rectification and fixation in a corrected or overcorrected position.

In the resistant cases (Table IV.), even of the severest sort, complete correction and permanent cure can be accomplished by forcible correction, even in grown patients.

It is probable that this can be done in all cases with repeated corrections by force; but in some instances, with unusual distortion of bone, tarsal osteotomy is a readier method.

Relapse. — There appears to be no greater liability to relapse after complete correction by mechanical means than when tenotomy is employed. But it must always be borne in mind that relapses will invariably occur unless the distortion is completely corrected, and in fact overcorrected. In club-foot half cures are no cures, and little reliance can be placed on the curative effect of time. Efforts at correction should be continued until the foot can be easily abducted beyond the median line, and while slightly abducted can be flexed so that the dorsum of the foot shall form less than a right angle

with the leg, the sole of the foot being flat, there being no twist in the front of the foot. After this the correction appliance is to be changed for a retention appliance.

Relapses occur in a certain number of cases simply from the carelessness of the parents, who are not aware of the necessity of retaining the corrected foot in the proper position for a long time. The foot of a healthy infant in arms is often held in an equinus position, which is often overlooked by the parent.

In cases where the counteracting muscles are congenitally weaker than they should be, there is, of course, danger that the gastrocnemius muscles become shortened by adaptive shortening, even if previously of sufficient length, as happens in the case of infantile paralysis. Where the foot is large and the child able to walk, the act of walking, if the foot is prevented from twisting and the weight falls correctly on the sole, is sufficient to stretch the muscles, so that this adaptive shortening does not occur. But in infants in arms this correcting influence is absent, and the retentive appliance needs to be carefully watched until the child walks and walks well. In cases of relapse a second tenotomy is advisable.

Relapses in older children are due to incomplete correction, either from a lack of thoroughness or from the existence of an unusual amount of distortion of the astragalus not suspected, and demanding osteotomy, or from too early removal of the fixation appliance. It may be said, however, that the larger the foot the less time, after complete correction, will a walking-appliance be needed.

In some instances of resistant club-foot it is found impossible, in correcting the foot, completely to overcorrect the equinus deformity, and to enable the foot to be brought within a right angle of the leg. If this is not done, inconvenience is felt by the patient in taking a long step, and the foot is turned in to facilitate this. The smaller the foot, the greater this danger. If this is not corrected, it may, in some instances, seriously interfere with the perfection of the result.

Relapses in infantile club-foot may also occur from the neglect of a fixation shoe. In children in arms the feet hang according to gravity, unless the muscles are of normal activity. The muscles in club-foot, even after correction, are not of normal activity; and the feet may relapse and deformity reappear, as in cases of paralytic club-foot. This may also result if the children do not walk correctly when they attempt to walk.

It should also be borne in mind that a distortion in the neck of the astragalus exists, even in infantile club-foot, and that the feet are not permanently corrected until the alteration of the facets into a normal position has taken place. This is independent of bringing the foot into a normal position, and demands fixation in a normal position for some time. In some cases this is more needed than in others, probably because the alterations of the facets of the astragalus are in some instances slight.

Imperfect Results. — The obstacles which prevent perfection in result are as follows: Imperfectly divided tendons; imperfectly divided ligaments,

plantar fasciæ; imperfectly stretched ligaments, plantar fasciæ; incorrect relation between the scaphoid and anterior facet of the astragalus, due either to anatomical alteration of shape of the astragalus or to imperfect division or stretching of the ligaments which bind these bones together, in the correction of the deformity.

Too great overcorrection of the deformity, and the development of a splay-foot have sometimes resulted from over-zealous treatment. The danger is, however, not great; and instances are rare, and are to be overcome by the treatment for a valgus foot.

Inversion of the foot, after cure of the club-foot, may in a few instances be observed from imperfect strength of the outward rotatory muscles at the hip. This, however, causes but little disfigurement, the inversion usually being slight, and corrects itself by the normal development of the muscles. A marked toeing-in of the foot in running persists a long time in some instances where the foot is entirely corrected and the walking is normal. It disappears with the increase of muscular strength.

A relaxed state of the knee joint causing inversion of the tibia is not uncommon in infantile club-foot; it usually corrects itself in the development of the child after correction of the foot. In rare instances, however, it may persist, requiring the longer use of a walking-appliance.

The treatment of congenital club-foot may be summed up as follows: —

It consists of complete correction and of efficient retention.

Treatment should be begun as early in infancy as is practicable.

Correction in infancy and early childhood can be entirely mechanical, and the amount of time gained by tenotomy is not great.

Tenotomy saves time in older children. In congenital cases tenotomy should be followed by complete correction and retention in a corrected position.

In children walking, the retentive appliance should not interfere with locomotion, should be readily applied, not unsightly, and be worn as long as there is a tendency of the foot to bear the weight unequally.

In resistant cases much force should be applied for correction; correction should be complete, followed by fixation; and after correction a retentive appliance.

Tarsal resection and tarsal section should be reserved only for the severest cases, where correction by force has only partially succeeded. These cases will be found to be very few.

Summary. — It has been said by some writers that the treatment of club-foot is one of the most unsatisfactory undertakings in surgery. The reverse has also been said; namely, that nothing is so gratifying as the correction of talipes equino-varus. Both statements are true; and in explanation of the contradiction it may be said that imperfect methods give extremely unsatisfactory results in club-foot, while success is sure to reward the proper methods thoroughly carried out. In no branch of surgery can a cure be more confidently promised than in the treatment of club-foot, and in few surgical undertakings do half measures occasion greater annoyance.

Discussion.

Dr. Moore. — I have taken a great deal of interest in the papers just read, and I think the authors have come to very sensible conclusions. The question with us is how best to treat these cases of club-foot; and I think that the man who is biassed in such a manner that he cannot make use of all the means we have at our command is at a great disadvantage. It is most unfortunate, for himself and patient. I agree with the Doctor fully. In the treatment of these cases each one should be dealt with on its own merits and necessities. If you can reduce a deformity satisfactorily and promptly without tenotomy, — as simple an operation as we are called upon to perform, — do it by all means. If we can accomplish it by means of an apparatus and tenotomy, that is the correct thing to do. If none of these will accomplish the desired result, then do osteotomy, — in short, do whatever is necessary to overcome the deformity. One point has been lost sight of in the treatment of these cases, and that is that the patient's time and the time of the parent are not sufficiently considered. If by any means we can get a satisfactory result within a few weeks or months that can only be brought about by a slower method in many months or years of treatment, I think it is imperative on our part to take the shorter method, because in the mean time if you are treating a patient (say two or three years by an easy method, one that is not so heroic as the more active surgical procedure), we must remember that the patient is growing all the while, and every step he takes makes the deformity in a measure worse. While you are gaining some, you are also losing some; the muscles become more atrophied; they are not gaining as you want them to gain. The great point to bear in mind in starting in the treatment of these cases is to bring about the proper position of the limb as quickly as may be with safety. It is rarely necessary to resort to osteotomy.

The Doctor's idea of using the chisel on the neck of the astragalus is one that I heard Dr. Bryant speak of some two years ago in New York; and I have practised it three times since, with satisfactory results.

Dr. De Forest Willard, of Philadelphia. — It is the treatment of the old inveterate cases of club-foot that taxes us most. I am glad to hear the members of this Association advocating the plan

of forcible straightening instead of tarsectomy, except in a certain class of cases. There are cases of adults where ligaments, bones, and fasciæ have become thoroughly hardened, in which we are obliged to remove a section of the tarsus; but I certainly do think that any amount of pressure up to a point compatible with the life of the soft parts is justifiable rather than section, unless we can do subcutaneous osteotomy. Pressure I believe to be superior to, and safer than, any form of instrumentation, as far as it can be done by the knee or hands of the surgeon. By simply placing a sandbag underneath the tarsus, the entire weight of the body can be brought to bear upon the resisting tissues. I do not care what gives way as long as I can get the foot straight with the skin unbroken, since the wound is subcutaneous instead of open, as in tarsectomy.

I have had sloughing and suppuration in one or two cases, but that was where I attempted too much. There are some old cases where the skin is so contracted that it will not stretch enough at the first operation to allow the foot to be put in its proper position. We can only go just so far as the skin will allow the first time, dividing subcutaneous tissue, fascia, tendons, and ligaments, — everything except the skin, — so that we may bring our full force to bear upon the resisting tissues. Rectifying the foot as far as possible, and as far as the skin will allow, but not to stretch to the point of sloughing of the skin. Fixing it in this position it can, at least, be three quarters corrected in the first operation. As soon as the soreness has passed away, and the skin has gained its normal degree of vitality, by a second operation we can rectify the remainder of the deformity. I have done this in patients nearly twenty years of age. I have photographs and casts showing that the result has been so perfect that these men are now walking without apparatus and with good, flexible feet. I believe also that forcible straightening is better than tarsectomy, for the reason that we have better walking feet afterwards. There is not as much ankylosis of the tarsal bones, and there is an elasticity to the gait, which is an exceedingly important advantage.

When manual pressure is insufficient, then I believe in the application of screw power.

In simple cases of talipes, manipulation stands first of all as a remedial measure.

Dr. Vance. — I have been deeply interested in all of the reports I have heard. I have had a little experience in the treatment of

club-foot, but have never tried forcible straightening or breaking up, except by manual force. There are one or two little points I would like to speak of, more particularly in the treatment of baby cases. I am in the habit always of correcting the lateral deformity first. I do that somewhat after the old plan by side splints, except I do not use expensive screw splints. I substitute gutter splints, made of hard rubber, which I can adjust perfectly, and can easily convert cases of equino-varus into cases of equino-valgus, and hold them there until they remain. I usually, in the treatment of baby cases, commence my first treatment about the tenth day and keep it up about six weeks; and when the child is about two months old I apply Scarpa's shoe for controlling the foot. If that is not satisfactory, I divide the tendo achillis, and have the foot curved prior to the child's beginning to walk.

In the resistant cases I am somewhat like Dr. Willard, — I endeavor by the hand to do what the other gentlemen accomplish by apparatus. I believe it is better to resort to the manual method in overcoming an equinus.

Dr. Hodgen. — I feel in case of children that there is no more necessity of taking four or five weeks or two months to correct an equinus that can be corrected in ten days by a simple method. I believe in the majority of cases in cutting the tendon and rectifying the deformity at once, not taking time to stretch it. I do not think there is anything gained by stretching the tendon. I think, in all probability, you will do as much damage in one case as in the other. In those cases in which the deformity can be corrected by the hands, I should certainly advocate doing it; I do not believe in breaking the skin if you can avoid it. I see no use in taking so much time to correct a varus when you can do it by manual force and at once.

Dr. Steele. — At one time the pendulum of tenotomy swung out too far. My own opinion in regard to these cases is, especially in infantile club-foot, that if they can be corrected without cutting, it would be far better. It is true time is saved to the patient, and labor to the surgeon; but certainly harm is done in performing tenotomy. The muscular tissue shortens, it contracts; and if after a while the tendon is again divided, the muscle shortens still more. Suppose this tenotomy goes on *ad libitum*, there would be left no contractile power to the muscle. If many divisions permanently impair a muscle, one division certainly weakens it. If these deformities can be corrected without tenotomy, it should be done.

A CASE OF REFLEX VALGUS.

BY GEORGE W. RYAN, M.D.,

Surgeon to the Orthopedic Clinic of the Medical College of Ohio, Cincinnati.

EARLY in May of the present year, I saw a robust lad of ten years, who was brought to me for advice concerning a deformity of the foot. He wore an apparatus which had been applied by an instrument-maker; but there had been no improvement in his condition, the father stated. The foot was in marked valgus as he walked, though there was little if any lameness. The history of the case was that, some months before, he had sprained the ankle, but it was not thought to be of much consequence and with home treatment passed off in a few days. It was some weeks after this injury, when it was noticed that, in walking, the foot was thrown in marked eversion. He complained of no pain, and was, in fact, unaware of the changed position of his foot until his attention was called to it. He was fond of play, and his activity was in no way diminished by the position which his foot assumed. The condition was believed to be "a habit," to use the father's words, and his pride was stimulated in various ways in an endeavor to have him overcome it. It was of no avail, however, and the family physician was consulted. The patient was turned over to an instrument-maker, who constructed a simple apparatus of two steel uprights, and an instep strap attached to an ordinary leather shoe. This had been worn for two or three months, when I saw the boy. There was no appreciable improvement from its use.

I made no inquiries concerning the family history, though the father was a man of highly neurotic temperament.

The examination of the foot showed a marked valgus, with a slight prominence of the scaphoid, the arch being as well marked as on the other foot. There was no swelling of the joint, no tenderness; in fact, nothing abnormal but the position. The

boy had complete motion in every direction but inversion, and in this lacked but a few degrees of perfect. When the foot was brought to the straight line, the prominence of the scaphoid was not apparent. I was careful to notice this, as the father informed me that the physician who had previously seen the case was inclined to think that a slight displacement of that bone was the cause of the trouble.

There was a little atrophy of the calf, — so little that it could have been but physiological. There was no contraction about the hip or knee, nor was there any tenderness. I examined the spine carefully, for a trace of tenderness, but found it sound in all respects. I did not use any electrical tests for the muscles of the leg.

This case impressed me at the time as a pure valgus, due possibly to a traumatism. The absence of pain and tenderness, and also of marked atrophy, with perfect motion, certainly excluded any bone lesion. The boy did not seem to be of the neurotic type, having no resemblance to his father. And further, he looked upon any treatment as a burden which would interfere with his accustomed outdoor enjoyment. He was a sturdy, outspoken boy, and was irritable only on the subject of the apparatus, with which he found all manner of fault.

I recommended the cold douche and massage for the leg, and measured him for an appliance, which consisted of a highly arched steel plate, to which the foot was bound by straps of webbing; a shaft extending up the inner side of the leg with a free joint at the ankle; the shaft or spring to be thrown out from 10° to 15° from a straight line. This was applied about a week later, and its immediate effect was perfect. He walked with the foot in the straight position. He was ordered to wear it day and night.

I did not see him for ten days or more, when he was brought to my office. It was reported that the foot was not doing so well, and that he was beginning to turn it out as before. It was admitted that the apparatus had not been worn constantly, as the boy complained of it at night. He certainly did not walk as well as when he was last seen, but not so badly as the father appeared to think. As the foot was released from the appliance,

it seemed to immediately settle into a more extreme eversion than I had before found. There was no excoriation, — hardly a redness of the skin. On taking hold of the foot, I found the peronic group of muscles firmly contracted; the contraction coming on as the foot was touched. The spasm was of the tonic type, and relaxed only after several seconds of gentle traction; and was marked also when an attempt was made to apply the sole plate to the foot, and intensified as pressure was made by the straps to draw the foot to the straight line. This was a new development; at least, I was very much inclined to believe so, as I had examined him very carefully at the first visit, and had detected nothing of this. The father knew nothing of it, and I believe the boy was unconscious of it, for I tested him in various ways, by attracting his attention to other matters which would interest him thoroughly; and while so interested, if the foot were touched the contraction again came on. There had been no pain, there was no swelling or tenderness, and he was as active as usual, walking without lameness. This symptom seemed to be brought on by the use of the shoe, and to be purely reflex. I believed that it might be overcome in a few days by the constant use of the appliance, and so advised, though I then thought that probably the case might have been a reflex (hysterical, if you choose) one from the beginning. At any rate, I concluded to try the support for a short time. The promise was readily given that this course would be followed, though I had some doubt of it. I have not seen the boy since.

The father came to see me just as I was about to leave the city in July. He said that the boy was no better, turned his foot out as much as before, the contraction was the same. I told him to let me see the boy on my return, and I would then dress the foot in plaster of paris, after the method used by Lorentz, of Vienna, in the treatment of ordinary flat-foot.

Reviewing the case now, I am of the belief that it was a neurosis; but if I were asked why so, I would be unable, perhaps, to say more than that I could think of nothing else, and also that the spasm of the peronic group did not imply anything more than a neurosis. But as I have attempted in the preceding notes to show there was nothing else which led me to this conclusion, I am

unable to say positively that the condition was of reflex origin. There was nothing in the boy's temperament, his habits or surroundings, or in his manner, to point towards anything bordering on the hysterical. It was certainly not a spinal arthropathy.

The neuroses of joints must have, I think, a peculiar fascination for every orthopedic surgeon, for the reason, perhaps, that their solution is generally a difficult matter. In the ordinary diseases of joints, we generally see them at second hand, when no special skill is necessary to make a diagnosis; it proclaims itself. I have found more difficulty in diagnosticating obscure ankle troubles than in any other joint, the hip or the knee being far more easily managed. I can recall several cases which I have seen in the past few years, — most of them in consultation, — when I insisted on further examination before giving an opinion, the symptoms about the ankle were so conflicting and obscure. In the hip or knee we are often able to determine at once the presence of the neurotic element. In the spinal arthropathies of children the cause is easily found, and its removal, as a rule, a matter of a few days. The management of neuroses of the ankle, it seems to me, presents unusual difficulties.

If there is any genital irritation, of course that is easily disposed of; but where no spinal arthropathy or genital irritation exists, there is very little that we can do in young children, but give general directions concerning exercise. Many of these conditions pass off without treatment, as easily as they come.

Tenotomy is often done in some of these neuroses; but it will be questionable as to whether any permanent benefit can be obtained from it. I am inclined to think that where there is such marked spasm in a single group, the fixed dressing would be more serviceable than anything else.

Discussion.

Dr. Gibney. — Mr. President: This is a very interesting case, but I failed to find from the reading of the paper whether the Doctor resorted to any special or neurotic treatment.

Dr. Ryan. — No, sir.

Dr. Gibney. — I recall two or three cases of that nature due to sciatica or some neuroses of the sciatic nerve, and since I have

had one of the cases under observation I find I derive most benefit in the way of treatment by employing counter-irritation over the spine, and along the course of the sciatic nerve, combined with galvanism. By these means I have accomplished a cure in the case I refer to.

Dr. Vance. — I do not know that I have seen a case of reflex valgus like that of Dr. Ryan's, but I had a case about eighteen months ago, which somewhat resembles it, except that it was of longer duration than his case. My patient was a very finely built young man, eighteen years of age, and this spasm of the perineii produced marked valgus. I divided the perineii in this case and put on plaster-of-paris splint, kept it on four weeks with the foot forced in the opposite direction. He derived great benefit from the treatment. I have not seen the patient since; but his father told me he was going to school, walking very much better, and wearing an ordinary boot. He finds a heavy boot is better than a shoe. I do not know whether it is the same sort of a case or not. I believed there was some irritation in the contiguity of the nerve. I could not discover any neuroses. He is an active country boy. No injury could be ascertained. The case has been under treatment for over a year. I understand Dr. Ryan's is only of a few months' standing.

Dr. Judson. — The case which has been related presents some of the features of *neuromimesis,* or hysterical joint disturbance. It differs from many cases of this class, however, in that the difficulty is limited to one part instead of appearing in different parts of the body. The character of the muscular action observed in this case reminds me of the tonic rigidity or reluctance to relax, which in spastic hemiplegia is generally found affecting extensive groups of muscles, instead of being limited, as in this case, to a small group.

Dr. Lewis Hall Sayre. — It is doubtful whether I have seen such a case as Dr. Ryan reports. I am sorry I did not hear the whole of the paper. Did it come on suddenly? No hysteria about it?

Dr. Ryan. — No, sir. He sprained his ankle, which was noticed for some weeks; but that soon passed away.

Dr. Sayre (resuming) said he had seen a case of marked valgus of both feet come on in an elevator-boy who was constantly on his feet. The boy had been perfectly well and active before, but gradually commenced to get valgus, which finally became so painful that it could not be reduced. There was marked spasm of the

perineal muscles in both feet, they being much contractured. They were divided, the deformity reduced, and the parts brought into a condition of varus and put up in plaster of paris. The boy was perfectly well after this, and has had no trouble since. Whether it was a case like the one described or not, I do not know; it is a question.

Dr. Ryan. — I thought that some of the members would have thrown more light on this case. Concerning Dr. Gibney's remarks about the spine, what attention was paid to it, etc., I would say I gave it no attention. There was no tenderness to be found over it, and there certainly was no sciatica in the case; the boy was absolutely free from pain.

Dr. Sayre in his remarks spoke of contracture; I stated simply contraction. The contraction was of the chronic type, was limited to the perineii group, and was brought on by simply touching the foot. In cases of this kind, I believe tenotomy would be useless. It would give immediate relief, of course, but in a case of reflex origin the spasm would likely return.

Dr. Judson speaks of it as being a hysterical case, but there were no symptoms to lead any one to suppose, in my judgment, that there was anything wilfully simulated.

OBSERVATIONS ON SEVENTY-FIVE CASES OF FLAT FOOT,

With Particular Reference to Treatment.

BY ROYAL WHITMAN, M.D., BOSTON.

Flat foot is, in the majority of cases, an affection independent of local or constitutional disease, which may develop at any age, the most important factor being overwork, for feet subjected to mechanical disadvantages, in attitudes of activity as well as of rest.[1]

The following points may be urged in support of this assumption, since the first essential in the treatment of any deformity must be a proper conception of its cause.

In the normal foot the astragalus has a tendency to slip downward and inward from off the os calcis. There are two principal reasons for this tendency: —

1. The weight of the body, transmitted through the astragalus, falls upon the os calcis at a point internal to its base, and thus tends to roll it over towards the inside, presenting an inclined plane for the support of the leg.

2. The displacement of the astragalus found in flat foot is simply an exaggeration of its normal position under weight; that is, the result of a rotation or slipping forward, downward, and inward, — the only movement which its articulating surface permits; a rotation, not only with the attached leg above, but also a slight independent rotation of its own, amounting in the normal foot, according to thirty measurements, to about four millimetres.[2]

[1] Mr. Lane, in his instructive article on flat foot in children, says: "A general want of tone and vigor is solely and primarily responsible for the condition, except in cases which have resulted from a wound or rheumatism." Under such conditions he considers the habitual assumption of attitudes of rest as the exciting cause. Guy's Hospital Reports, 1887.

[2] Boston Med. and Surg. Journal, June 14, 1888.

Thus it is apparent that an increased rotation of the astragalus will increase the instability of the os calcis, and, conversely, a depression of the internal border of the os calcis will increase the rotation of the astragalus; and that an increase in the weight to be supported, or a decrease in the strength of the supporting muscles and ligaments, may result in the symptoms and appearances of flat foot.

In flat foot, then, we may expect to find a sinking and rolling over of the os calcis, an exaggerated rotation with inward and downward. displacement of the astragalus, the scaphoid displaced downward, and with the forefoot outward; so that the leg will appear to be rotated inward upon the foot, or rather the foot will appear to be displaced outward upon the leg. These displacements are accompanied by overstretched and ruptured ligaments, weakened muscles, and, in time, permanent changes in bone and soft parts.

Thus overweight or overwork, sudden or gradual, or weakness of muscles either from disuse or from general or special disease or accident, may induce the condition known as flat foot; and in all, whether it be the weak ankles of the growing child, the painless flat foot of rachitis, or the acute cases in adults accompanied by inflammation and muscular spasm, we find to a greater or less degree the anatomical conditions which have been described; and although certain cases can perhaps be explained by the various hypotheses which have been advanced, none will so satisfactorily account for the great majority as will the simple mechanical theory of its causation.

The natural mechanical disadvantages of the foot have been still further increased by faulty attitudes assumed in standing and walking, and by disuse of the muscles of the foot, with deformities caused by improper shoes. To illustrate: As the foot is dependent on muscular strength and activity for its support, evidently anything tending to produce muscular weakness or to place the muscles at a disadvantage will tend to cause a giving way at its weakest part, which is the inside, for reasons which have been stated. The attitude of muscular weakness, as shown in infancy and old age, is with the feet wide apart, and the toes widely separated, to increase the base of support.

On the contrary, the attitude of muscular strength and activity is with the feet well under the body, and the toes pointing straight ahead, as illustrated by the antique statues. The walk of muscular inactivity and weakness is the walk of flat foot; the step is short and inelastic, the toes widely divergent, the weight borne almost entirely on the inside of the heels. The foot resting flat upon the ground is lifted by an exaggerated bend of the knee, the final strain falling entirely on its weakest part.

The walk of muscular activity and strength is with the feet under the body and the toes pointing straight ahead, so that the weight, falling first on the outside of the heels, is transmitted along the outside of the foot; the body is then lifted by a well-marked flexion of the foot, in which the toes assist. The final impulse is given by the powerful muscles of the great toe, the forefoot being slightly adducted. Thus the arch is almost entirely relieved from strain; the gait is elastic, and the step is longer than in the preceding.

As flat foot must cause the walk of weakness, so an approximation to the attitude and walk of weakness may induce flat foot. It is to this point I wish to call attention, because it has been almost, if not entirely, overlooked by writers on this subject.

The usual walk of civilization is an approximation to the walk of weakness, (1) because the muscles of the foot are weakened from disuse, — for the ordinary shoe causes not only direct atrophy of muscles from pressure, but indirectly, from corns, bunions, and deformities of the toes, which render flexion of the foot a painful act, consequently it is avoided. (2) The foot is subjected to a mechanical disadvantage by the exaggerated turning out of the toes, the result of habit and instruction as well as of weakness and deformity. Children are constantly reminded to turn their toes out in walking; in the military drill of the public schools they are obliged to stand for long periods, the angle of divergence for both feet prescribed by tactics being 60°, but often increased to one of 90°.

In such positions the strain on the feet is greatly increased, especially in the attitude of rest, when the weight of the body falling on one foot must be borne by the unsupported ligaments.

The walk, with little or no divergence of the toes, is the walk intended by Nature. The construction of the foot shows it particularly, in the diagonal line of the balls of the toes, — the outer

Fig. 45.

the short, the inner the long side. With the foot in the proper position, this outer side first bears the shock of weight, and fixes

the forefoot; the scaphoid is raised and approximated to the os calcis, relieving the strain on the ligaments.

Fig. 46.

Fig. 45 (drawn from life) shows the correct position of the feet in walking; Fig. 46 (drawn from life), the incorrect. A line drawn through the patella downward to the floor will show where the strain falls, — in Fig. 45 through the middle of the foot, in Fig. 46 across its weakest part.

As the leg is extended, the astragalus (the forefoot being a fixed point) must, from the arrangement of the knee joint, rotate outward with the leg. An exaggeration of these movements will throw the foot into a position of varus (see right leg in Fig. 45); thus, every correct step is a safeguard against flat foot.[1]

Not only is this position of the foot correct anatomically, but it is the position of ease and grace, as shown by the healthy barefoot child, the moccasin-wearing Indian, and by the statues of the sandal-wearing Greeks.

In Sir Joshua Reynolds's third discourse before the students of the Royal Academy, delivered Dec. 14, 1770, occurs the following: "For in the same manner and on the same principles as the student has acquired the knowledge of the real form of Nature as distinct from accidental deformity, he must endeavor to separate simple, chaste Nature from those adventitious, those affected or forced airs or actions with which she is loaded by modern education. Perhaps I cannot better explain what I mean than by reminding you of what was taught us by the Professor of Anatomy in respect to natural position and movements of the foot. He observed that the fashion of turning them outward was contrary to the intent of Nature, as might be seen from the weakness that proceeded from that manner of standing."

Observation will show that fifty per cent of children walk with the feet in proper position; while in ninety per cent of adults a divergence of the toes is habitual, and in a considerable proportion greatly exaggerated.

Thus we may have the two factors — muscular weakness and faulty position, which sudden strain, overwork, or disease may develop into flat foot.

Of seventy-five cases of flat foot treated at the Boston Dispensary during the past two years, thirty-six were men, twenty-six women, and thirteen children. Of the thirty-six men but six were more than thirty years of age; in three only was there any complication of disease or weakness. Of the twenty-six women, eleven were less than thirty, while twelve were more

[1] If the toes are in front of the body, they must be walked over; that is, the weight of the body must be lifted by the muscles attached to the foot. On the contrary, in the position of excessive divergence, the feet are used simply as passive mechanical supports, and are pushed along by the legs.

than forty; the greater number of whom were fat, and altogether too heavy for their feet, while fifteen per cent were rheumatic. Of the children but two were free from weakness or disease.

This is, as might be expected, according to the theory which has been advanced, typical flat foot being more common in young men whose feet are subjected to greatest strain and weight. In women, whose work is of a lighter character, the proportion is greater in later life, for reasons above mentioned. In children not subjected to overwork, as a rule, the affection is usually the result of constitutional weakness.

FIG. 47.

Fig. 47 (from a photograph taken at the Boston Dispensary) illustrates the more severe class of cases in which muscular exercise alone is useless, — a barber who standing all day by his chair "has endured misery for fourteen years."

As it is evident that treatment should be directed to cause rather than effect in these cases resulting from general or local

disease, I shall confine myself to the treatment of the affection as it usually occurs, independent of either.

Flat foot being essentially a dislocation, it is evident that its symptoms can be relieved, and the functions of the foot restored, only by a reduction of the misplaced bones, and their retention in normal position.

If such retention can be accomplished by a suitable brace, then, by an avoidance of faulty position, and in exercises for strengthening the muscles, we may hope for permanent cure.

It is asserted, however, by those who reject all forms of support, that this result can be best accomplished by gymnastic exercises alone.[1]

It is true that the milder cases can be relieved by this means, but only with patients who have a personal, persistent, intelligent desire to follow instructions, with the ability to take the necessary rest, and, in a certain measure at least, to avoid the conditions under which the affection developed.

Among the poorer classes not only is the desire or ability to follow directions wanting, but there is, in addition, the necessity of a continuance of the daily labor which was the direct cause of the affection. *Operative treatment*,[2] except in special cases, on anatomical grounds, and particularly in the light of published autopsies, may be rejected, as it could not be successful in severe and chronic cases, while the milder grades of flat foot may be cured or relieved by less extreme measures. *The treatment recommended by Smith*[3] — a forcible re-position of the foot, under ether, and its indefinite retention in plaster bandages — may be objected to, on the ground that such retention would interfere with the movements of the foot, and prevent the exercises for strengthening the muscles, on which we must place our main reliance; and that permanent cure, by this means alone, is unlikely, as the author admits that long standing and walking must be avoided.

If a support is to be used at all, it should be efficient and comfortable. We may therefore object to the indirect support

[1] Roth, N. Y. Med. Record, March 17, 1888; T. S. Ellis, Lancet, Sept. 25, 1885.
[2] Ogston; Stokes, Annals of Surgery, October, 1885.
[3] The Practitioner, January, 1887.

afforded by shoes of peculiar shape as recommended by Thomas[1] and Mayo Collier,[2] as being inefficient; to *pads* of horsehair, india-rubber, or felt, as not only inefficient, but, according to those who have used them, often painful; to *elastic supports* — that is, an elastic band passing under the arch and attached to the corset[3] or to a steel support,[4] as being likely to cause painful pressure, to interfere with the action of the muscles against which they press, and because, from the nature of their elasticity, they must give, under weight, and thus allow the displacement of the bones which it is their object to prevent.

This last objection may also be urged against *steel springs;*[5] for it must be remembered that with the foot in its proper position the normal arch does not, to an appreciable extent, sink under weight, as would seem to be the impression of those who recommend elastic supports or springs, the abnormal sinking of the arch in flat foot being exactly what we wish to prevent. *The only inelastic brace* with which I am acquainted, though a very useful appliance, is open to the following objections, — that it is heavy, and, reaching from the heels to beyond the balls of the toes, acts as a splint, interfering with the natural movements of the foot, and causing an awkward gait; and that it is not entirely efficient as a support.

It would appear, then, that a brace should be constructed on principles somewhat as follows: it should be *light*, *inelastic*, *comfortable*, and must not to any extent interfere with the movements of the foot or the action of its muscles. As, from the excessive divergence of the forefoot, the metatarsal bone of the great toe has borne more than its share of work, it should be supported; the other metatarsals should be unsupported.

The brace must fit the foot perfectly, and prevent displacement, especially at the moment when weight is borne, when there is always a tendency for the foot to slide off from any support.

[1] H. O. Thomas.
[2] Lancet, Sept. 4, 1886.
[3] Green, Lancet, Dec. 26, 1885.
[4] Walsham, Lancet, Dec. 26, 1885; Sayre, Orthopedic Surgery.
[5] Lane, *loc. cit.*; Sayre, *loc. cit.*

An attempt has been made to meet these requirements in the brace which is presented for your consideration. It is constructed as follows: The flat foot is by manipulation replaced as far as possible in its normal position.[1] The foot being at right angles to the leg and slightly flexed at the medio-tarsal joint, a plaster cast is taken, on which the lines for the plate are drawn.

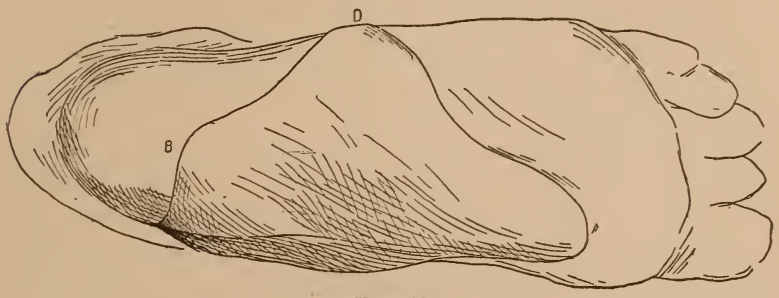

Fig. 48.

Fig. 49.

The point A is made beneath the ball of the great toe, just short of its bearing centre; a point B, just short of the bearing centre of the heel bone, beneath its inner tuberosity, so that the foot

[1] In an acute case, accompanied by pain, redness, and swelling, the foot should be placed for a few days in a plaster bandage in an adducted and inverted position; afterwards rubbing and bandaging will bring it into condition for the plate. In old cases a forcible breaking up of adhesions and re-position under ether is sometimes necessary.

may rest upon its natural supports; C, just above the head of the astragalus, a little in front and below the internal malleolus.

These three points are now connected by a gradually ascending line from A, rising above the inner border of the foot, a little in front of the internal cuneiform bone, curving upward above the scaphoid, meeting at C the line drawn upward from B.

A curved line is drawn, three quarters of an inch in length, whose centre corresponds to a point D on the outer aspect of the foot, just above and behind the tuberosity of the fifth metatarsal. The extremities of this line are now connected with A and B, and the pattern is completed.

The brace should be made of thin-tempered steel, accurately moulded on the cast. It presents the following peculiarities: It has the two bearing points A and B, while the extremity D forms a lever, caused by the slight flexion of the foot during the taking of the cast; for although in standing the entire outer border of the foot rests upon the floor, as may be seen from the imprint of a wet foot on paper, the medio-tarsal joint being flexed, this outer border is slightly raised, an interval of one quarter to one third of an inch intervening between it and a line drawn from the heel to the head of the first metatarsal.[1] The brace being fitted to the cast in this position, it results that the foot in standing or walking will press this external arm or lever solidly against the sole of the shoe; consequently the tendency will be to press the internal flange more firmly against the weak portion at the moment when the tendency of the foot is to slide away from it.[2] This pressure during the step has a tendency to throw the weight more on the outside of the foot, and to turn the toes in, resisting the tendency to exaggerated abduction. It is worn next the stocking, may be changed from one shoe to another, and its presence cannot be detected. Its weight is about an ounce; it may be nickel or silver-plated, or the inside covered with rubber plaster to prevent rusting. Well-fitting laced shoes on the Waukenphast pattern, with broad soles and low heels, should be worn.

[1] The outer third of the arm D must be perfectly flat, so that when pressed down it may lie smoothly against the sole of the shoe.

[2] The leverage should be just sufficient to cause the brace to hug the foot closely when weight is borne.

Objections have been urged against this class of support: —

1. That they prevent the natural movements of the foot.

This is not true of the brace which has been described.

2. That they cause painful pressure; an objection which is disproved by practice.

3. That they are theoretically wrong, as it is impossible to provide pressure at the proper place.

As to this, it may be said that the bones of the foot are so closely bound together that a change in the position of one necessitates a corresponding change in all the others. A proper brace will prevent the downward and outward displacement of the scaphoid; to a great extent the inward rotation of the astragalus; and, most important of all, the sinking and inward rotation of the anterior extremity of the os calcis, — a movement which unhooks it from the cuboid, thus not only directly preventing the deformity, but indirectly by its suggestiveness, for a brace accurately fitted to the foot in a proper position can only be uncomfortable to the foot in an improper position. In other words, to avoid uncomfortable pressure, the patient voluntarily assumes the correct position in standing or walking, — a position which will necessitate activity of the muscles.

Thus the best exercise for flat foot will be the simplest, —a proper walk.

Games which employ the feet, such as skipping rope, tennis, dancing, also bareback riding, bicycling, etc., are to be recommended. Also exercises for the bare feet, such as raising the body on tiptoe with the toes in an inverted position; walking a mark or narrow plank; raising a weight by a cord running over a pulley, as recommended by Mr. Ellis.[1] In addition, manual flexion and inversion of the foot is often of service.

As to results, there is no affection for which treatment conducted on simple mechanical principles is more satisfactory to patient and physician than typical flat foot.

The more acute and disabling the symptoms, the more rapidly efficacious the remedy. In old cases, with permanent changes in the bones, we can scarcely hope to do more than relieve the symptoms; neither can we expect a fat middle-aged man or

[1] Lancet, Sept. 26, 1885.

woman to greatly improve the muscular tone by gymnastic exercise.

The brace is designed as a temporary support; but the length of time it should be worn must vary according to the case.

In conclusion, it would seem that weakness of the feet may often be prevented by teaching children the proper attitudes in activity and rest, and by avoiding improper shoes. The ideal shoe should have a sole approximating in shape the Greek sandal, as thin as circumstances will allow, for a stiff sole acts as a splint to the foot. Young children might wear the Indian moccasin, and surely fashion need not dictate the shape of tennis shoes, now so universally worn in summer.

Discussion.

Dr. Henry Ling Taylor, of New York, in opening the discussion, said: "I came here to learn, and Dr. Whitman has taught me a great deal. His paper is an admirable one, especially from an anatomico-physiological standpoint. In discussing the subject of flat foot, we should consider the foot as an arch in two directions, — longitudinal and transverse. The bones of the foot compose the arch, and the plantar ligaments form a tie-rod connecting the pillars of the arch. When from local or general causes these ligaments are weakened, then the bones composing this arch settle down and assume abnormal positions, and the arch flattens out. In these abnormal positions you will get false relations; and in sensitive subjects, or when the destruction is great, you will get sluggish forms of local irritation, or even inflammation often will cause discomfort. The physiological way to walk is to walk on the heel, the outside of the foot, and the heads of the metatarsal bones. To correct relaxation of the arch, we must invert the foot, hold it in the inverted position, and approximate, if possible, the heads of the metatarsal bones to the os calcis, in order to relax the ligaments of the arch which have been stretched. It seems to me that most methods of treating flat foot by pressing up on the inside of the arch instead of relaxing the ligaments, tend to stretch them, and may do harm. An apparatus which will hold the foot in the inverted position, transfer the pressure to the outer border, and keep the plantar ligaments relaxed, and allow free movement at the

ankle-joint in order that the muscles may be used, is the proper one to use in severe cases. I am perfectly convinced that ligaments are not so resistant to treatment as is usually supposed; they will stretch or shorten as they are subjected to or relieved of strain. Any pressure made on the inside of the sole against the tissues which support the arch does not cure cases, but, by producing atrophy, is rather a source of danger, and would require us to continue our treatment indefinitely. I believe we should so treat our patients to relieve this already overloaded part of pressure rather than use means which increase the pressure. An apparatus like Dr. Taylor's valgus brace, which takes its pressure against the outside of the foot and leg and inside of the ankle and is even inside the shoe, answers the indications."

Dr. Bradford said he had used Dr. Whitman's sole brace in the treatment of one case, and it proved very efficient, and was certainly worthy of trial. He had tried the one shown by Dr. Roberts at the last meeting of the Association, which he thought was inferior to that of Dr. Whitman, although he had not tested its usefulness in more than one case.

Dr. Gibney. — I was much interested in the paper, especially in the new form of brace. It seems an admirable one. I shall take pleasure in trying it.

With regard to the objections as to the building up of the shoe, as recommended by Thomas, on the inner side, which the Doctor mentioned incidentally in his paper, I would say, if you get a shoemaker who seems to appreciate what you tell him, and who builds a shoe according to instructions, you will be enabled to afford your patients a vast amount of relief. I have not used the spring of Dr. Roberts, except in one or two cases, and those cases I lost track of. The spring was easily adjusted. I would like to bear testimony to the efficiency in my hands of the method of throwing the shoe up on the outer side. If you carry the sole-leather through the shank, and make the shank and the inner border of the heel even, bringing it down towards the ball of the toe and stopping it there, I have in this way afforded great relief to my patients. I have been practising also, in addition to this means of treatment, certain gymnastic exercises, — not the extensive ones recommended by Mr. Roth, of London. For instance, I have my patients walk across the floor, morning and evening, a half-dozen or twenty times on the toes and balls of the feet, then on the outer border of the foot, for a change, twenty minutes to half an hour morning and

evening. I also employ the cold douche at night. This method seems to me worthy of trial, and I would therefore recommend it to the Association.

Dr. Lee. — The great toe is really the efficient agent in walking, so far as the foot is concerned. The interesting analysis to which we have listened in the paper just read of the *modus operandi* of locomotion in the human foot, has impressed me especially as bearing upon the point that if we wish to have sound and strong locomotion we must attend to the first metatarsal bones and phalanges associated with them. In using any form of support to the arch of the foot, it is absolutely essential that we should also insist upon such a shoe as will give free play to the great toe. While the foot first touches the ground on the outer side, yet, as the weight comes to be felt, it is borne by the inner edge, and especially by the end of the metatarsal of the great toe; therefore we must give them free play.

As regards the benefit of support to the arch in these cases, I am a firm believer in it; and the brace exhibited might, I think, prove extremely serviceable.

Dr. Vance had been greatly interested in the Doctor's paper, it being on an important subject. There are no class of cases more obstinate to treat than those old cases of flat foot over eight or nine years of age. He had been treating a great many so-called weak-ankle cases. In former years he had learned to make shoes of every kind, thus being able to talk to a shoemaker in his own language. When he settled in Louisville, he sought out two good shoemakers, — one to do work for men and large boys, and the other to do work for women and children; and since then he had had great satisfaction in the treatment of flat foot of every degree, both in children and in adults, by shoes alone: the treatment being supplemented by tenotomies when this was thought necessary; the feet after this operation being forced into varus, and held so for three or four weeks by the plaster case.

Dr. Ridlon was inclined to believe that much more of the difficulty in flat foot is due to muscular causes than to ligamentous ones. If muscular weakness and atrophy has much to do with deformities of the feet, then the fact should hold good that anything which causes constant pressure upon the muscles of the soles of the feet, in maintaining of the arch, weakens, rather than strengthens, those muscles, and by that much delays the cure of the condition. He was inclined to think that these deformities, like all

other deformities and diseases of the feet, are simply the result of a divergence of the human animal from the laws of Nature which should govern him. Like other animals, the human animal was intended to go barefooted, and he did not think that flat foot had been seen in any barefooted races of mankind.

Dr. PHELPS said he had but little to add in regard to flat foot. He fully believed that the object of treatment was to so place the foot as to transmit the weight of the body through the tarsus in an oblique direction; that is, through the cuboid, instead of the scaphoid bone. This could be accomplished by a thick sole on the inner side of the shoe after the arch had been pushed to its normal position by means of plaster of paris. He was much pleased with the original ideas of the paper, and would be pleased to try the appliance.

He had recently performed an operation for flat foot which consisted in making an incision across the sole of the foot; and through this incision the muscles and fascia were hooked up, cut apart, shortened, and again stitched together. The skin was also shortened. The object of the operation was to shorten the girders which held up the arch. At the next meeting he hoped to be able to report the result of the operation, not only in this case, but in others.

Dr. ROYAL WHITMAN, in closing the discussion, said he desired to correct Dr. Gibney in calling his brace a *spring*. He would consider any brace or appliance useful which would prevent the displacement of the bones; but, other things being equal, the cheapest, simplest, and least conspicuous would be the best. Dr. Vance's shoe required special skill on the part of the physician and shoemaker in its manufacture. The appliance recommended by Dr. Taylor should ordinarily be reserved for the very severe cases, since it was somewhat cumbersome and conspicuous.

OSTEOTOMY FOR ANTERIOR CURVATURES OF THE LEG.

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One of the most frequent deformities produced by rickets is a forward arching of the bones of the leg, which deviation is very often associated with a lateral curve of both tibia and fibula.

Rickets is a constitutional disease, and is so seldom seen in country practice in healthy districts, that physicians frequently overlook the early symptoms, which are manifested by an indisposition of the child to be lifted, by peevishness, and by general symptoms of mal-nutrition. Ordinarily these conditions are attributed to indigestion, and certainly the stomach and intestines are largely at fault in the production of this state of defective digestion and still more defective assimilation; but simple indigestion does not give the beaded ribs or "rickety rosary," the softened cranial bones, the cranio-tabes, the lengthened dolichocephalic skull, the open fontanelles, the softened bones, the excessive head sweatings, the flabby muscles, and the enlarged epiphyses, — deformities so characteristic of rhachitis. Rickets is essentially a disease of early childhood, is rarely congenital or hereditary, and only occasionally develops at or after puberty. It differs entirely from either tuberculosis or scrofulosis.[1] In small cities it is rare; in larger ones it is found in proportion to the existing amount of filth, squalor, bad air, scanty food, and deficient light. When found in the rich, it can be traced to improper non-fatty food or hygiene. In this country the colored race is more affected than the white, and the results are also more serious.[2]

[1] Ashhurst, International Encyclopædia of Surgery, vol. i. p. 251.

[2] Transactions American Surgical Association, 1887, p. 261.

While it is a constitutional disease affecting all the tissues of the body, yet its worst manifestations are exhibited in deformities of the bones. These deformities are due to the relative preponderance of the organic over the earthy tissues in the bone, and the failure of the formative cartilage cells to produce true bone cells. This is the stage of softening; and during its progress, if the child is allowed out of bed, the osseous tissues are unable to sustain the superincumbent weight and consequently easily yield to a greater or less degree. Not only do the tibia, fibula, and femur become bent, but the pelvis is deformed; and either from creeping or from being lifted, the humerus, or the radius and ulna of the patient, may also be distorted. In severe grades even the clavicles are arched.

Upon the resumption of proper assimilation, however, the deposit of earthy salts begins, and then follows the stage of *sclerosis*, or hardening, which permanently fixes the distorted bones in their faulty positions.

Among the most frequent of bone deviations are *anterior tibial curves*. These are not produced by contraction of the gastrocnemius, for the calf-muscles are at first flabby and only become shortened at a later stage. The distortion may extend in a long curve from knee to ankle, or it may be abrupt and angular at any portion of the bone, usually the lower third.

The treatment of these anterior curves is accomplished by

I. Manual Straightening and the Use of Apparatus.

In the second and third years of life, if the bones are still either soft or springy, it is possible to correct the deformity by frequent manual straightening, provided the mother or nurse is willing to give the requisite time and patience to the case. The pressure should be as forcible as the integrity of the bone will permit; this will give the child pain for only a few moments after the force is removed. This pressure should be repeated many times daily. If gentle manual pressure could be constantly applied, it would doubtless, as in club-foot, be perfectly curative. Instrumental pressure, made in the proper direction by spring power or by strap connected with steel uprights,

may be employed, in connection with manipulation, during this stage.

After the bone has hardened, however, I agree with Gibney[1] in saying that I have never seen a case of anterior curve of the tibia of any magnitude reduced by apparatus. Many surgeons spend months in attempting to straighten the bones in these cases, and then condemn the patient to perpetual cripplehood; whereas a slight operation will produce a perfect cure. The conditions are mechanically entirely different from those met with in legs bowed laterally.[2]

II. Forcible Fracture.

A. *By the Hands.*

B. *By the Osteoclast.*

A. *Manual Fracture.* — In children under three years of age, by far the safest and best plan to be adopted, is fracture of the two bones at the proper point, if the surgeon possesses the requisite strength. For additional power the knee may be used, or the child may be placed upon its face and a very small sand-bag, or a wide roller bandage, be used as a fulcrum. Frequently it is timidity rather than lack of strength that prevents success. Up to the point compatible with the life of the soft parts, its great advantage lies in the fact that only a simple fracture is produced, and speedy union is the result.[3] The objection to the plan lies in the inability of the surgeon to regulate exactly the point of fracture.

The proper dressing after manual fracture is fixation, as described under osteotomy.

B. *Osteoclasis.* — The osteoclast, while a very efficient instrument in the thigh, yet in the leg has the great disadvantage that pressure must be made upon the sharp edge of the tibia covered only by thin skin. It offers the advantages, however, that in the centre of the bone, pressure can be applied to a definite point,

[1] Transactions Academy of Medicine, New York, 1886, vol. xlv.

[2] Medical and Surgical Reporter, July 25, and August 1, 1885; Archives of Pediatrics, 1885, p. 680.

[3] Dublin Journal Medical Science, vol. lxxix. p. 483.

and that its resultant is a simple fracture, provided sloughing is avoided. When the apex of projection is near to either epiphysis, however, neither the Rizzoli pattern nor any of its modifications is easy of adjustment.[1]

III. Osteotomy.

A. *By chisel:* 1. Simple. 2. Cuneiform.

B. *By saw.*

A. *By chisel.* — Both simple and wedge osteotomy necessitate the production of a compound fracture; but in the former the operation is almost subcutaneous, and in the latter there is the absence of contusion and other ordinary accompaniments of such an injury. The results may therefore be expected to be very much better, provided strict asepsis is enforced.

The procedure which I have found most effective is as follows:

On the day previous to the operation the leg should be shaved, then washed with soap and water and afterward with ether, after which it is enveloped in towels which have been dipped in sublimate solution (1–2000), and then dried. These will remain *in situ* until the patient is etherized, when the final washing with bichloride (1–1000) is made. Instruments are first to be placed in boiling water, then in carbolic acid solution (1–20). The rubber cloth should be placed on top of the sand-bag, and then covered with a single layer of wet bichloride towels. The region of the operation should be well surrounded with carbolated towels. One of the osteotomes should be both wider and thicker than the other, the latter being used in the deeper portion of the section so as to prevent wedging. I have never been unfortunate enough to break off an instrument in the bone; but this accident has occurred in the practice of experienced surgeons, and a portion of the chisel has been allowed to remain. I should prefer to loosen and remove it by cuts alongside.

The osteotome should taper gradually, not abruptly, and should be driven by light taps of the mallet after the anterior cancellous tissue has been passed, lest a splintering or a long oblique fracture be produced. Several times while rapidly demonstrating

[1] New York Medical Journal, 1886, vol. xliii. p. 129.

this operation to a class, I have in the cadaver made a fracture that extended obliquely for many inches. The posterior one-fourth of the bone should always be fractured manually, lest the instrument injure the artery, which, from displacement, may lie directly behind or alongside the bone. Dandridge[1] was unfortunate enough to lose a patient from pyæmia, after an injury of the posterior tibial artery and vein, which both lay directly against the tibia.

1. *Linear Osteotomy.* — In simple osteotomy an Esmarch bandage is not desirable, as the outflowing blood is of advantage in effectually preventing the entrance of air.

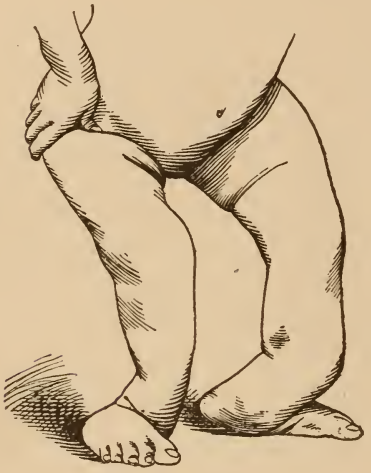

Fig. 50.[2]

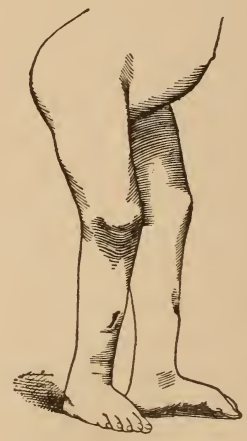

Fig. 51.[3]

In regard to the cases suitable for the simple cut, experience has taught me that even where the angle has been very promi-

[1] Boston Medical and Surgical Journal, 1885, vol. cxiii. p. 25.

[2] Fig. 50 shows only the lower half of the body; but in this case nearly every long bone was curved. Locomotion was impossible except with a waddling gait and with the trunk supported upon the thighs by the hands. When the patient stood, each tibia rested upon the dorsum of the foot. Both legs were "cork-screwed," and the femora bent both outward and forward. All the epiphyses were enlarged, and the elbow articulation was so distorted that the arms could be only partly flexed. Both clavicles were sharply bent forward at their centres.

[3] Fig. 51, from a photograph, shows the result of the osteotomies in case shown in Fig. 50.

nent, there is no necessity for taking out a wedge, as Nature is abundantly able, provided no septic influence is introduced, to unite the bones solidly even if they were angularly placed. The incision with the knife should be directly down through the periosteum, and should be no longer than just sufficient to permit the osteotome to turn crosswise without tension. In children the fibula need not be touched, as it can be easily fractured; but in the sclerosed bones of lads or adults, a separate section will be necessary. The larger osteotome should not be removed from the bone until more than one third of the diameter has been traversed, although it should frequently be moved sidewise to prevent wedging, and to incise different portions of the structures in large bones. The smaller instrument should be carefully inserted in the exact track of its predecessor.

An operator soon learns to distinguish the increased density of the compact tissue when the posterior region is reached, and will withdraw the osteotome before it has penetrated this layer, when fracture will readily complete the solution of continuity.

Rectification being now performed, section of the tendo achillis is usually done with benefit, as it relieves much of the tension upon the parts, permits better adjustment, and reduces the tendency to future displacement. Irrigation with sublimate solution should be frequently practised during the progress of the section; and upon the withdrawal of the instrument an aseptic sponge should at once close the wound, and remain in position.

Without waiting for hemorrhage to cease, unless it be profuse, all tissue is removed from between the edges of the wound, a few strands of catgut introduced, and the lips drawn together by catgut suture or strip of adhesive plaster — preferably the former. Irrigation should be continued until the sublimate gauze (freshly wet, in children, with 1–2000 solution) is actually in place.

I have abandoned both protective and iodoform. Dry sublimate cotton is now applied as a roller to the leg and foot, and is held in position by an antiseptic or a flannel bandage.

Plaster-of-paris rollers soaked in warm salt water are now applied, the limb is extended, and the deformity *slightly overcorrected*, until fixation is complete. To insure accuracy of position

the plaster encasement of the leg should first be completed; an assistant then rests the heel of the patient upon the thumb and finger of one hand and grasps the toes with the other, which position he must maintain during the envelopment of the foot and the setting of the plaster. As a rule, but little morphia will be required, and if no pain or odor is present, and the temperature is good, the surgeon will have little to do for four or five weeks, as the case progresses to good union without suppuration.

The temperature chart is not an infallible guide as to the condition of the parts, yet it is one of the best indications; and if no evidences of suppuration exist, the dressing need not be interfered with, as disturbance of any wound, so long as it is sweet, is harmful. Should the cast become loose, it should be sawed open, the leg examined to see that good position is maintained, and the encasement drawn closer together by a bandage.

If other osteotomies are to be performed at the same operation, each fracture as it is produced should be wrapped in a sublimated towel, while a pledget of antiseptic cotton is fastened over the wound. A temporary wooden or pasteboard splint should be applied, lest in the manipulations of the subsequent operations the muscles and possibly the blood vessels should be lacerated by a sharp-pointed fragment.

2. *Cuneiform Osteotomy.* — The removal of a wedge-shaped piece from the tibia is only necessary when the angle of curvature is very great, and especially when it approaches the right angle. To determine the amount of bone necessary to be excised, one soon learns to judge with sufficient accuracy by his eye. If exactness is desired, the sphenometer[1] may be used, or the anterior surface of the limb may be outlined upon a piece of stiff paper. This line, paralleled by one at about the supposed antero-posterior diameter of the tibia, will give the size of this bone. When the pattern is cut out as drawn, a rude representation of the tibia will be secured which, when cut through at the point of the curvature and straightened, will at once show the size of the wedge.

As a cuneiform section is much more serious than simple osteotomy, every aseptic precaution should be used to prevent

[1] Therapeutic Gazette, 1887, p. 154.

suppuration. These have already been enumerated. The application of a sterilized Esmarch bandage assists greatly in the proper formation of the wedge, by giving a good view of the cut bone surfaces. A chisel, bevelled upon one side, is used instead of an osteotome.

If rigid, and in large children, the fibula should be first divided, but the removal of a wedge from this bone is never necessary. The knife incision over the tibia should be a little larger than the proposed base of the wedge, and the periosteum should be cut not only longitudinally but also laterally, in order that it may be preserved intact without laceration, and that it may be subsequently sutured.

The wedge is not taken away entire, but is made rather by a series of chippings until the proper amount is removed.

The posterior portion of the bone is fractured by manual force, as in simple osteotomy. If the instrument is driven too rapidly, or carried too deeply into the bone, a very oblique fracture may result. Tenotomy of the tendo achillis should always be performed if there is any restraint against rectification.

Many surgeons fasten the ends of the bones with wire,[1] silkworm gut, kangaroo tendon, etc.; but I see no necessity in the majority of cases for the delay and for the additional incentive to suppuration. In angular malunion following fracture, however, I always use the inter-osseous suture, as there is ordinarily a tendency to non-union. Upon the removal of the Esmarch bandage the hemorrhage will be very free from the cut surfaces, but hot water or eburnation will usually arrest it. Stuffing the wound with alum gauze is rarely if ever necessary, and if it is used the material should be removed within twenty-four hours. Drainage, while unnecessary in simple osteotomy in which organization of blood-clot will occur, is here of the greatest importance for the prevention of suppuration.

All fragments of bone should be thoroughly removed by irrigation (with 1 to 2000 sublimate solution, in children), and the ends brought closely together *without any pinching of tissues.* A failure to observe this rule will ensure defeat, as will also the

[1] St. Bartholomew Hospital Reports, 1886, vol. xxii. p. 40; also 1884, vol. xx. p. 59.

retention of any tissue in the lips of the wound when it is closed by catgut sutures. Either sterilized horse-hair or catgut may be used for drainage; I prefer the former.

When there is an opening at the fibula a roll of horse-hairs is carried into the tibial wound with a pair of forceps, and made to emerge at the opening of the former; another small bundle is carried directly through from the bottom of the wound to the posterior aspect of the leg through a counter opening. Catgut may be allowed to remain permanently, although I prefer to take it away, as I do the hair, in thirty-six hours.

In applying the dressings, the same thorough precautions are necessary to obtain asepsis until the moment that the wound is covered with gauze. The sublimate cotton, plaster bandage, etc., are applied as before, except that the latter is put on as a recurrent longitudinally along the sides of the limb at the seat of operation, in order to give additional strength laterally. In front and behind, at the site of the proposed windows, the cast is made thinner and the ends of the horse-hairs arranged so that they can be withdrawn without interference with the remainder of the dressing.

A slight overcorrection of the deformity is advisable while the plaster is setting, and extension should also be made in order to secure good apposition of the fragments. When windows are cut in the cast on the second day, the staining of dressings with blood does not necessitate their removal so long as decomposition has not taken place. A moderate wetting with sublimate solution after the withdrawal of the drain will prevent all odor for a week or ten days, when union of the soft parts will have occurred, and a fresh dressing may be applied through the opening. Care should be taken that pressure should be accurately made upon the tissues beneath the window, lest local œdema and pain ensue. Usually these cases go on to speedy and perfect union. Occasionally, through some fault in the operation or in the dressing, suppuration ensues, in which case the cast about the opening should be coated with shellac, the wound thoroughly washed and antiseptically dressed, when the cessation of pus formation may be soon secured.

In the case from which the accompanying figures were pre-

pared, while one limb healed kindly, the other suppurated, and several particles of bone were discharged; nevertheless, a perfect union and a good leg resulted.

I have never ventured beyond six osteotomies at one time, but as high as ten have been performed.[1] It is my custom to rec-

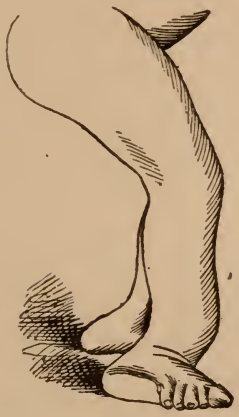

FIG. 52.
Double knock-knee, with double anterior curves.

FIG. 53.
After osteotomy.

tify coexistent knock-knee by a simultaneous supra-condyloid osteotomy (Figs. 52 and 53); but I have always left the high curve which so often exists in the femur, intending to do section later. Thus far, however, all my cases have been so greatly improved in locomotive powers that I have hesitated to incur the possible risk of rotation of fragments or of placing the head of the femur after reunion in a new relation to the acetabulum; and have also reasoned that as both pelvic and thigh muscles had for years accommodated themselves to the abnormal positions, more or less disability might occur by throwing them into new mechanical relations. All my sections at the upper end of the femur have been for hip-joint ankylosis, and in cases in which I did not expect to secure the proper apposition of femoral head and acetabulum, since both had been either greatly altered or already destroyed.

[1] Dublin Journal Medical Science, vol. lxxix. p. 292; MacEwen, Transactions of Eighth International Medical Congress, Copenhagen, 1884.

B. *Section with the Saw.* — Several very oblique fractures which have recently been produced by me in making sections of the bones by the osteotome and chisel, in which very sharp ends of fragments have rendered injury of the soft parts and blood vessels imminent, have led me to look favorably upon the operation with the saw. I have never practised it upon the leg bones, although frequently employing the saw on other bones. The section could be performed almost absolutely subcutaneously, and I have never had suppuration follow its use in other cases. The saw should be blunt-pointed, should have a short cutting face, and the puncture with the knife should be only just large enough to admit the saw. Care should be exercised that neither blood vessels nor nerves are injured.

Will the deformity return? Doubtless, if too early locomotion is attempted without support, or if a febrile or other exhaustive disease speedily follows the operation. Such a softening of the callus before it is thoroughly ossified is possible after any fracture, but is rare. Should it accidentally occur, the case should be treated as one of malunion or of delayed union: that is, first, by re-position and fixation with gypsum; then, secondly, by open osteotomy and wiring of fragments, with long-continued subsequent support.

Conclusions. — 1. Anterior tibial curves during the soft and springy stages may be corrected by manual rectification and the use of apparatus.

2. Instrumental pressure is useless after hardening has occurred.

3. Manual fracture is the best and safest remedial operation in young children.

4. Instrumental fracture, or osteoclasis, is not as safe or effective as osteotomy.

5. Aseptic simple osteotomy, for all moderate degrees of curve, and cuneiform section for very severe grades, give almost uniformly good and speedy results, without suppuration. Subcutaneous section by the saw is also a reliable operation.

6. Plaster of paris is the simplest and most effective material for securing accurate position and maintaining absolute fixation. By its use the delay and injury incident to suturing the ends of the bones is avoided.

FEMORAL OSTEOTOMY

For the Correction of Deformity resulting from Hip-joint Disease.

BY AP MORGAN VANCE, M.D., LOUISVILLE, KY.

In the part of the country from which I come, we have to deal with more of the different deformities resulting from neglected cases of hip and knee joint diseases than are met with in the larger cities, where greater attention has been given to the treatment of this class of troubles in the earlier stages.

It has been my fortune to treat a number of these unfortunates, and it is to relate my experience in a clinical way that I am here to-day. There are one or two points I wish to emphasize. While in New York, a little over a year ago, I spoke to a distinguished surgical friend concerning subcutaneous osteotomy, and was astonished at his saying he had never mustered sufficient courage to do this operation; that he always made a large open wound, so that he could see what he was doing. This was a new idea to me, as I could not see any reason for the additional work. I have broken a number of bones subcutaneously, and have never had a feeling of any doubt of exactly what was being done, and have never had a single mishap, every case in its progress being practically a simple fracture.

I freely confess that I will break a man's femur subcutaneously with as little misgiving as to the outcome as I would divide his tendo achillis.

The procedure will be described during the relation of some eight cases of femoral osteotomy, all the patients having practically reached adult life, the justifiability of the operation having been proved by the results.

Of the eight cases to be reported, five were operated upon for deformity the result of hip disease, and the remaining three for deformity following disease at the knee.

The latter cases have proved to me how much better it is to correct, by a bone section, deformity existing at the knee along

with slight motion and the patella fixed, than it is to interfere with the formerly diseased joint in an effort to better the condition.

Cases Nos. 2 and 6 have been reported before, in the "New York Medical Journal;" but, to complete a series, I will refer to them again, as illustrating the advantage of subcutaneous osteotomy.

Case 1. *Subtrochanteric Osteotomy (?) in a Young Woman aged Sixteen.* — Carrie H. came under my observation first in the spring of 1883, giving this history: Two years before she had been attacked with acute pain and evidences of inflammation about the left hip. She was under the care of skilful surgeons in the town where she lived, in a northwestern Territory, who repeatedly aspirated a large abscess which formed, the sac being located on the outer side of the thigh. The abscess finally healed, and, under tonic and constructive treatment, the child gradually recovered, being confined in bed for nearly a year, with weight and pulley attached to the limb, and sandbags also used to keep the limb in the best position and the joint at rest. Notwithstanding their extreme care, the hip became stiff, as is often the case in extreme adduction; so, when she began walking, there was a practical shortening of four inches and a half or five inches, and, of course, a very marked lateral curvature of spine and obliquity of pelvis.

For the relief of this deformity the parents brought their daughter East; and after a thorough examination I advised non-interference, but told them, as they were going farther east to New York and Boston, to see surgeons at each place. They did see Dr. Sayre and some Boston surgeon, who agreed with me that there was bony ankylosis at the hip, and the result was too good to be interfered with. But after three years had passed and the girl had reached womanhood, the deformities grieved the parents very much, and, after communicating with me, who had hinted at bone-breaking as the only chance of correction, they came East again, and on April 16, 1886, the bone section (?) below the trochanter was done as follows: A firm, well-padded block of marble was pressed against the inner side of the thigh as high up as the perineum would allow. A

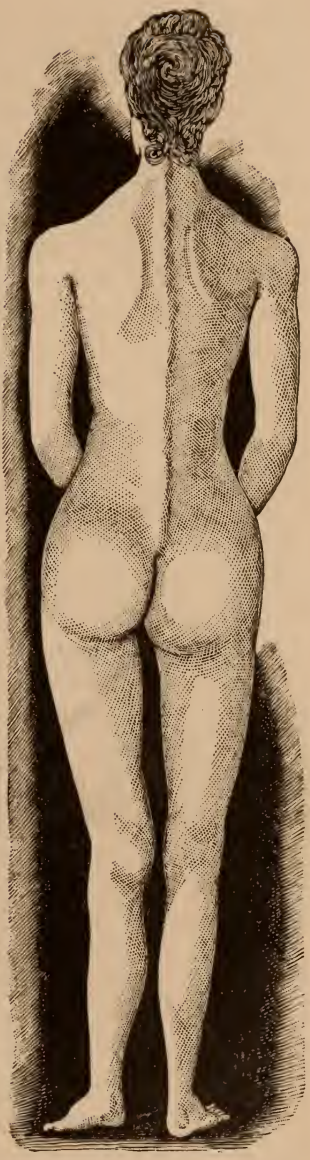

FIG. 54. Case 1. FIG. 55.

very sharp narrow chisel was pushed through the soft parts, the blade in the axis of the limb, the skin at the same time

being drawn forward. When the bone was reached, the chisel, being turned, was driven through until the hard substance on the opposite side was reached; this was partially divided; the chisel was then slightly withdrawn and directed posteriorly and then anteriorly. Without withdrawing the instrument, an effort was made to complete the fracture by using the block for a fulcrum and the femur as a lever, an assistant fixing the pelvis firmly to the table, the patient being on the right side. This failed, even after great force had been applied, for the reason that the adduction was so great the fulcrum could not be placed opposite the weakened point, but below. Further work with the chisel was then done. The instrument became very firmly fixed, a loud snap being produced when it was moved. All present believed it had been broken, but, on withdrawing it, to our relief all of it appeared. The effort to fracture was repeated, and the bone gave toward further adduction; then very easily, when force was applied, toward abduction. The deformity was completely overcome, and the limb was incased in plaster of paris. Not a bad symptom arose during the after-treatment. She was able to be up in a rolling-chair by the fourteenth day, and walked on crutches by the eighteenth, when a lighter tarboard splint, reaching only to the knee, was substituted for the heavy plaster of paris. At the end of the sixth week she was allowed to walk without crutches, the limb being restored to a position which let the foot reach the floor; at the same time the pelvis was horizontal. After she had walked very well for a week, using a cane when on the street, the mother noticed a tendency toward the old position when she was tired. Upon examination, to our utter astonishment, we found considerable motion at the hip joint on this side, which allowed the limb, from prolonged habit, to drop into adduction. The question arises, Were we deceived in thinking the bone was broken, or was the marked deformity corrected entirely by the renewal of motion of what was undoubtedly a fibrous ankylosis, or did I break both the bone and the ankylosis? I lean to the latter opinion, not believing that the deformity could be so easily overcome without a fracture. The fact that the chisel was withdrawn destroyed my guide to what took place at the site

of its introduction. As the result is, the patient is much better off, being relieved of the short limb and lateral curvature, with a movable instead of a stiff hip.

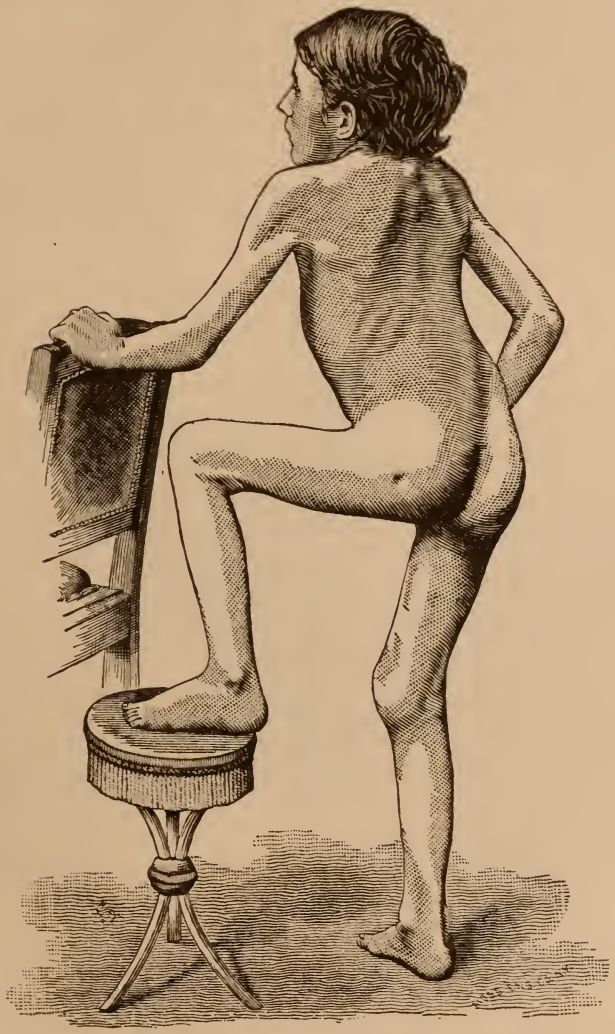

Fig. 56.— Case 2, before operation.

Case 2. — June 11, 1884, H. C., aged nine years, the subject of spinal caries and true hip disease, both long since spontane-

ously cured, the hip being ankylosed by bone at an angle of less than 90° with the pelvis, the deformity resulting being greater because of the spinal disease in high dorsal region, which took up most of the power of compensation in the lumbar spine.

This boy could stand with difficulty by holding on to his left knee and right hip, but could not walk, his mode of locomotion being on all fours. The patient was an inmate of the Methodist Orphans' Home, and ready consent to the operation was obtained; and, on the date mentioned, it was performed in the presence of the visiting physicians of the institution and several other professional friends. The patient was anæsthetized by Dr. Senteny, and the operation was performed just as in Case 1, except that tenotomy of the muscles going to the anterior superior spinous process of the ilium was done in addition, when without much difficulty the limb was brought down and fixed in plaster of paris, 90° of deformity being overcome. The wounds were dressed with compresses of absorbent cotton, and the case was treated as one of simple fracture, going on to conclusion without a bad symptom, the boy being able to walk at the end of five weeks. He walks any distance without difficulty, using an elevated shoe to compensate for about an inch and a half shortening of the affected limb.

April 3, 1888. — This boy is seen and examined. He has discarded the high shoe and can walk remarkably well. He has developed in a general way very much, having attended school regularly since the operation, four years ago, and takes part in the different sports of the other boys without any difficulty with his limb.

Case 3. — April 6, 1888, Nick M., aged fourteen years and a half, from near Versailles, Ky. A case of old hip disease which had been cured for six or seven years, — in malposition. The left thigh was flexed to about 90° with the pelvis and adducted very much, making this limb practically four inches and a half short, including an inch and a half real shortening from a pathological dislocation. There was very slight motion between the femur and the pelvis. The boy walked by aid of a cane with marked limp, and became very tired when he under-

took to go any distance. There had been an abscess, and a deep cicatrix was present below the trochanter.

Fig. 57. — Case 2, after operation.

Osteotomy was performed just as in the preceding cases, and tenotomies were done of all the muscles resisting abduction and

extension. The limb was placed in a plaster-of-paris splint in a position of abduction, so that the inch and a half real shortening would be compensated for by the obliquity of the pelvis resulting when the limb would become vertical in walking. There was no mishap during the after-treatment, and the patient returned to his home at the end of four weeks with a protective splint of leather, which was worn for a week longer and then discarded.

Sept. 7, 1888. — Boy examined again. He walks with remarkable ease and comparatively little limp. When standing, he rests his weight on this limb. Has three quarters of an inch added to his shoe. The motion at the joint has allowed the abduction to be almost overcome, and the pelvis is nearly horizontal. The whole limb has been greatly developed in the five months since the operation, and the patient is in much better general condition. This is the first case of deformity of the hip with motion remaining that I have corrected by osteotomy. As I stated in the opening of this paper, I should prefer this to interfering with the formerly diseased joint.

Case 4. — Jennie H., aged fifteen, came under observation on July 1, 1885, in the female surgical ward of Louisville City Hospital, where she had been operated upon for a supposed fistula in ano. Soon after this I was asked by Dr. Douglass Morton to treat the case for a deformity, the result of an old hip disease. The left limb was found greatly deformed, the girl being unable to get the foot to the ground. The femur was flexed to an angle of 90° with the pelvis and completely adducted. There were a number of old scars about the trochanteric region, and the examination under chloroform proved the joint to be ankylosed by bone. There was a sinus along the left side of the rectum, and the ordinary operation by incision had been done without any good resulting. On careful examination, it was discovered that the source of the discharge was an old fistulous tract through the buttock toward the joint site. I considered there must be dead bone at the bottom of this, though none was discovered. By Nélaton's test the thigh was estimated to be an inch and a half short. I determined to correct the angle of deformity, despite the existence of the dis-

charging sinus, as the patient was in excellent general condition, and I felt sure I could break the femur below the trochanter without disturbing the old joint. On July 20, 1885, in the presence of several of the attending staff, I did the operation just as described in Case 1, except that the fulcrum, instead of being placed opposite the point of entrance of the chisel, on account of the extreme adduction, had to be placed posteriorly in the region of the gluteal fold, and consequently the difficulty of applying force was greater and the fracture harder to complete. This was done, however, without very great trouble, and the limb brought into the best position for future use, after tenotomy of all the muscles in the adductor region which showed any resistance; also the muscles going to the anterior superior spinous process of the ilium, which became tense when extension was made.

The limb was then fixed in plaster of paris from the toes to the umbilicus. There was no bad symptom, and the patient returned to her home on the fourteenth day, after the application of a lighter splint, which was removed two weeks later, and moderate use of the limb commenced, July 30, 1888. The patient has rounded off into complete womanhood; gives a history of having had no trouble with the limb; can walk any distance without difficulty. The sinus still discharges watery fluid in small quantities. She wears an elevated shoe of an inch and a half; little or no limp. I advised her to have the sinus laid open and scraped before getting married, which is contemplated.

Case 5. — June 7, 1886, Miss T. H., tailoress, aged thirty-two. This woman had been the subject of true hip disease when eight years of age. At the same time there was disease of the right wrist and the shoulder of the same side, small pieces of bone being exfoliated. The right hip was the one affected, as will be seen by referring to the sketch. It was about the worst-looking deformity of the kind I had ever seen; the femur was flexed to the last degree and completely abducted; the knee could not be extended beyond a right angle, adaptation of the flexors having taken place during the twenty-two years. She had walked on a popliteal crutch. The pelvis was obliqued to the right, and the spine greatly curved.

This patient had been an eyesore to me for years on the streets, and finally was referred to me by Mr. Mathews, an artificial-limb maker, to whom she had applied for the repair

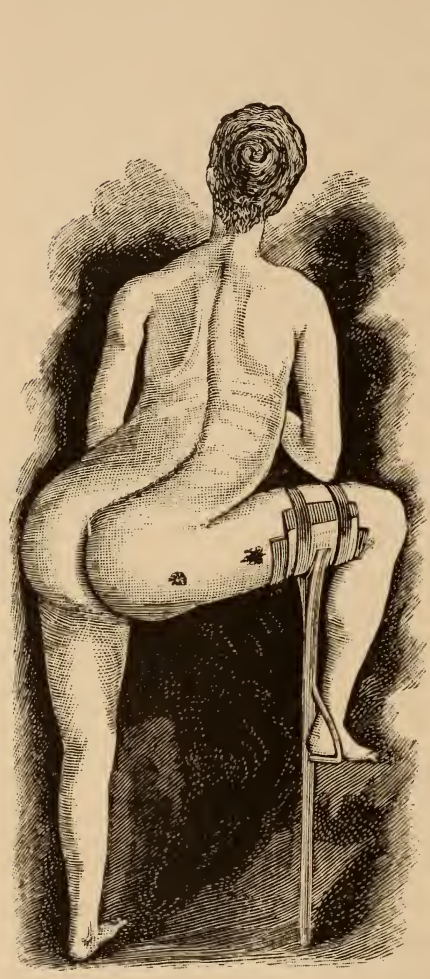

FIG. 58.

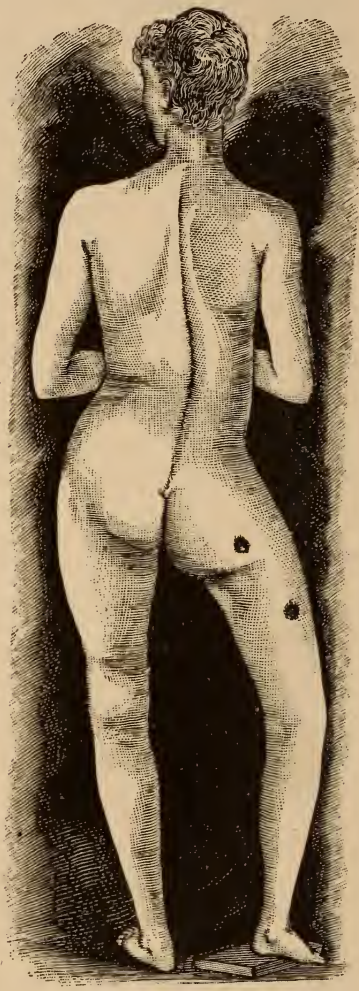

FIG. 59.

Case 5 before and after operation.

of her crutch. On the above-mentioned date I divided the right femur below the trochanter, and restored the limb to a position to be used to the best advantage under all the circumstances

in walking after the fashion of other people. Both hamstrings were divided, and the muscles attached to the anterior superior spinous process of the ilium also, great force being necessary to bring the limb down; the skin on the anterior aspect of the thigh looked glazed, it was put so much on the stretch. A plaster splint was applied, as in the other cases. Convalescence was uninterrupted so far as the firm union of the bone was concerned; but there was a tendency to swelling of the leg, together with anæsthesia of the parts supplied by the anterior crural nerve, for six months or more.

Examined Sept. 7, 1888: She is in better health than ever before, and can walk long distances without using a cane. Has no trouble of any kind with the limb. She wore for a while a shoe on the right foot of an inch elevation against my advice. She now wears an ordinary shoe. The limb was left in sufficient abduction to compensate for the actual shortening and part of the obliquity of the pelvis. The charcoal sketches before and after the operation give a very perfect representation of this case.

Case 6. — A. B., aged seventeen years, came under observation in November, 1884, for treatment. There were the history and the evidence locally of an old inflammation of the left knee joint, dating back to early childhood. The limb was greatly deformed, and he walked with painful inconvenience. The knee was found with very little motion, flexed at an angle of 135°, the leg being very much rotated in its relationship to the thigh; there was combined with this marked genu valgum. The compensating deformity of the foot was quite great, and walking painful.

The procedure of dividing the bone was exactly as in the preceding cases, the final steps being much more difficult because of the limited motion at the knee, and the fear that it might be further damaged if too much strained by the use of the leg as a lever; but I succeeded, by having the upper part of the bone fixed by a very strong assistant, then, grasping the condyles in both hands, with the application of sudden force downward, using the same fulcrum as before, the fracture was completed and the deformity overcome, after tenotomy of the external

hamstring tendon. The limb was dressed in plaster, and went on to firm union as a simple fracture.

The young man now walks anywhere without difficulty, and is the possessor, comparatively speaking, of a comely limb, a compensation of an inch and a half being added to the shoe.

Case 7. — Mr. N., clergyman, aged thirty-two, had been the subject of inflammation of the right knee when a child, resulting in a permanent deformity very much like that described in Case 6, — flexion, combined with rotation of the leg on the thigh, and knock-knee. He came, he said, to consult me in regard to the possibility of having the deformity overcome, as it was particularly awkward in a public speaker. I proposed bone-breaking as a possible remedy, and after some discussion he consented. His consent was more difficult to obtain because he had consulted with an eminent surgeon in Virginia, who had warned him against letting anybody meddle with his knee. On May 10, 1886, the operation was commenced just as in the preceding case, the bone being completely sectioned, however, without the use of manual force. Hardly had two strokes of the mallet been given before a complete fracture was produced. I anticipated a retardation in the process of repair, but no trouble was experienced, and in the usual time he was able to use the limb.

I saw him on the street in April last, and he walked with little limp; and if it had not been for this, one would not notice anything the matter with him. While he is standing there is no reason to suppose him at all lame. His limb gives him no trouble.

Case 8. — April 15, 1888, John S., aged fifteen, telegraph operator, Hopkinsville, Ky. The deformity, a repetition of that in the two preceding cases, was the result of an inflammation of the right knee of only three years' standing. The procedure was carried out as in Cases 6 and 7, with the same result. He returned to his home on the sixteenth day, wearing a posterior leather splint. There has not sufficient time passed since the operation to determine the result in this case, but I expect just as useful a limb as in the other cases.

Cases 6, 7, and 8 illustrate how much good can be done by a bone section in a class of cases that, in my hands, have been very unsatisfactorily treated in any other way unless excision is done. You have a knee in which the patella is fixed, with flexion, rotation of the leg on thigh, and genu valgum, without the saving clause of bony ankylosis of the tibia to femur, but with limited motion, with no control of that motion. The history of these patients as to the utility of the affected limb is always the same, — constantly recurring pain and disabling at the least misstep or stumping of the toe. Any movement which puts a strain on the crippled joint brings about the same result, calling for a return to the cane or more often to the crutch.

By a bone section and the substitution of an angle above for those at the knee, and at the same time rotating the leg, we place the tibia and fibula in the same axis with the femur, and restore the foot to a position much better suited for walking. By the improved relationship the intermittent strains are prevented and adaptation of the ligamentous structures allowed to take place, a firmer and much better joint being the result.

Discussion.

Dr. Gibney. — I would like to say with regard to the question asked by Dr. Willard as to the experience of the members in operating on these cases of antero-lateral curvatures, that I have met with the same difficulties that he has. I have not considered so closely the relationship of the head to the acetabulum. The same difficulties the Doctor refers to, I have experienced in applying my plaster dressing after operating. I have found that a dressing simply carried up to the perineum and around the trochanter major was insufficient to hold bones in place; so in one or two cases I have on the second and third day taken my dressing off, and have applied the plaster-of-paris splint from the calf up to the free ribs, making, in other words, a long spica bandage. By this means I have secured excellent results, in that I have overcome the deformity and got union in the usual time, and thus overcome one of the chief obstacles.

There is another class of cases he has not drawn attention to. I refer to a class where there is not only antero-lateral curvature, but almost a luxation of the tibiæ backward. The question is how best to get all the bones into position; whether it is better to divide the ligaments and force the subluxated ends up, or whether it is better to do osteotomy and bring them up in position. This has been a source of considerable annoyance to me. The photographs of the first case which the Doctor has passed around fairly represent that class of deformities we sometimes call "corkscrew deformities." We must do several operations to correct it. That has been most puzzling to me. I had hoped the Doctor would tell us how to treat those cases.

Dr. Vance's paper has interested me very much. It brings to mind a host of cases that have come to me with increased hope of success, — namely, that class of deformities long after disease about the hip, and after prolonged attacks of fever, such as typhoid, and cases of that kind; and I am very glad to hear the gratifying results of his operations, and to see the instruments he presents. I am very sure he has opened up for us a field of great usefulness.

Dr. Bradford said that the subject of osteotomy formed one of the most gratifying chapters in surgery. Osteotomy is done in all severely deformed rachitic children at the Boston Children's Hospital, where the bone has become hard. Linear osteotomy is preferred in anterior tibial curves to wedge-shaped osteotomy. The operation has been done so many times and with success, that it is hardly regarded at the Institution with more apprehension than a tenotomy. There have been no mishaps following the operation.

Dr. Moore. — I believe, as a rule, the orthopedic surgeon operates too little. I believe the general surgeon operates too much, and that there is a happy medium we have not yet attained, but hope to attain. It will be difficult to settle just what case shall be operated upon and what one shall have apparatus applied. I think that antiseptic surgery has some things to answer for as well as the great good it has done. It has made men reckless, in some instances operating on cases where more simple procedures would undoubtedly have answered as well. The reports of osteotomies heard here to-day are good, yet there are a great many cases which have terminated fatally that have not been recorded. That may not have occurred in the Doctor's practice, but he certainly knows of some. I know of a number having occurred, not in my own

practice, but in the practice of better surgeons than myself. It therefore behooves us to be careful in these matters.

Dr. Vance has made one advance in that he uses a smaller instrument, and the operation is more nearly subcutaneous than that of others. We cannot with impunity make a compound fracture any more than we can with impunity cut into the ankle joint. I claim, therefore, that in many of these deformities of long bones the osteoclast is the proper instrument to use.

I fully agree with Dr. Willard that osteotomy is the operation for anterior tibial curves, because the shape of the limb is such that you cannot bring pressure to bear without injury. I have applied the osteoclast with a child under an anæsthetic, and have straightened the limb without breaking it, and have had satisfactory results. It makes no disturbance whatever afterwards.

Dr. Ryan. — Concerning the question of osteotomy in these deformities, I do not think it is wise to perform the operation unless the bones are hard. I think we should use some mechanical means of support, if there is any possible way of doing good. The favorable statements made of the operation, and I do not refer to any particular one, lead a great many operators to attempt it. I was present and saw the case that Dr. Willard referred to in his paper. The child was lost. The surgeon cut the post-tibial artery, hemorrhage came on, and it was difficult to secure the vessel, and the child died in a few days of pyemia. In an operation of this sort it seems to me we are taking some risk in performing the cutting operation. In a child of four years, and where the bones were hard, I performed linear osteotomy; did not attempt drainage, and had no fear of suppuration. The boy got well without any difficulty. The question of age has a great deal to do with these operations. The bones are much harder in some children than in others, but the "springing" test will readily show whether the curves can be corrected by mechanical means, and I believe, as a rule, an operation should not be performed where there is hope of correcting by other means. Further, I do not doubt but that in the accomplished hands of one of the speakers an osteotomy may seem as simple as tenotomy, but I can hardly agree to it as a general proposition. Such statements, I believe, lead men to attempt operations for which they are not prepared, and with unhappy results. It is a question whether this should concern us, but we may be making history to-day.

Dr. Phelps. — In regard to osteotomy, I would say that a surgeon should never perform the operation unless he practises anti-

septic surgery. The statistics of mortality have been largely made up of cases in the hands of incompetent or careless men. When the operation is properly performed it is no more attended with danger to life than many of the forms of subcutaneous myotenotomies. The case of death reported here by Dr. Ryan is clearly one of septicæmia, an accident which should never occur in any osteotomy; and such cases should not be classed as deaths from osteotomy, but charged to the accident of the operator.

Suppuration is due to germ life; and when germ life produces suppuration and septicæmia in any case of osteotomy, it is because it has been introduced into the wound, either by the chisel or by the hands of the operator or his assistants.

In two hundred osteotomies, I have not seen suppuration, or non-union, or a temperature above 102°, and I would expect to perform a thousand operations with the same results. Osteoclasis should be resorted to only in deformities remote from joints. A bone should never be broken close to a joint, for fear of injury to epiphysis or joint. The Rizzoli osteoclast is the best and cheapest. No deaths have been reported from osteoclasis. The fractures are always transverse, and the periosteum only broken on the opposite side from the screw. For these reasons I perform osteoclasis in the shaft remote from joints, but prefer to do osteotomy where the rings and screws are set, or when pressure is made with any osteoclast the soft parts are crushed to the bones, but they repair very quickly. Injury to joints has followed osteoclasis, and separation of the epiphysis is not uncommon in osteoclasis for genu valgum. I have had one case of severe traumatic knee-joint inflammation, due to the improper use of the osteoclast.

Dr. Willard would like to say one word in regard to Dr. Vance's paper. He could heartily agree with his conclusion that osteotomy below the trochanter was infinitely safer than rupturing of the old adhesions.

In regard to the general question of osteotomy, he rarely did the operation in young children. If it was necessary to do an operation, he would fracture the bone by manual pressure. He could ordinarily break any child's bones under three years of age.

With reference to the corkscrew deformities, of which Dr. Gibney had spoken, as was illustrated in the photograph of the mulatto girl, these would require multiple osteotomies.

With regard to the question brought up concerning the adaptation of the head of the femur to the acetabulum, any one looking

at the difference and appearance of the child in the photograph, after the operation, could see how great and marked was the change of position.

Dr. VANCE, in closing the discussion, said: "There is one point I would like to make. I believe that Dr. Willard spoke of the operation as being 'almost subcutaneous.' I hold it is practically subcutaneous, — in fact, as much so as any other operation we call subcutaneous. It should therefore be called subcutaneous osteotomy rather than 'almost subcutaneous osteotomy.' I am in the habit of using a small chisel, as I think as much work can be done with it without as much injury as results when the larger chisels are used. The only difficulty in some of the deformities about the hip was to get a fulcrumage. The adduction cases were much more difficult to deal with than the abduction."

THE MECHANICAL TREATMENT OF SENILE COXITIS.

BY HENRY LING TAYLOR, M.D., NEW YORK.

By "senile coxitis" (malum coxæ senile), I understand a rheumatoid affection of the hip joint occurring in old people, and characterized clinically by local pain, muscular spasm, wasting, stiffness, and disability, but never showing a tendency to suppurate. It may or may not be associated with similar troubles in other joints.

When the hip joint of an elderly person becomes affected in the manner indicated, the cause is usually referred to a dyscrasia with joint manifestations, called rheumatoid arthritis, — an affection not confined to the aged, and probably having small affinity with tuberculosis, gout, or rheumatism. Its characteristic local lesions are eburnation and atrophy of the bearings of the joint, with hypertrophy and proliferation of its peripheral parts not subject to pressure. Some cases of senile coxitis may have a different causation and morbid anatomy with a similar clinical picture.

The usual treatment is medicinal, dietetic, and local; but many patients go through the various stages of local sensitiveness and disability, sometimes with moderate constitutional reaction, often with long remissions of the active symptoms, until finally the affected joints become crippled and nearly or quite useless. Can anything be done for such of these helpless old people as seem likely to resist, or have already resisted, orthodox treatment?

It is stated that malum coxæ senile sometimes follows directly on local traumatism; and while it must be admitted that some cases of impacted fracture of the neck of the femur may have been confounded with inflammatory trouble in the observations, we cannot help noticing the positive effects of traumatism in determining or aggravating attacks.

It would seem, on general physiological grounds, that the strain and pressure of attempted free locomotion must aggravate the local difficulty, and that an attempt might reasonably be made to allay irritation and improve the local and general nutrition by efficient mechanical protection to the disabled hip joint. If it is feared that these old people cannot or will not submit to mechanical measures, we have not found it so in our experience; indeed, I am able to make the broader statement that adult or advanced life is a much less unfavorable factor in orthopedic practice than is usually supposed. Nevertheless, in devising a plan of treatment for senile coxitis, unnecessary confinement of body and limb has been avoided.

In several cases which had resisted previous treatment, and the patient seemed urgently to need help, we have tried the plan of applying counter-traction thoroughly, and then protecting the joint from all traumatism for a considerable period. The patient is put to bed with the long counter-traction hip splint and extra weight attached, the leg being supported in a sling. At the end of a month or six weeks we find the muscles about the hip joint softer, and position and mobility improved, and allow the patient to go about on the jointed supporting splint ("Dows'"), which protects the hip joint from pressure, but allows motion at the hip, knee, and ankle. The patient is thus enabled to enjoy the benefit of fresh air and moderate exercise with a certain amount of healthy stimulation to the now quiescent joint, through the protected and pressureless motion. If progress is not satisfactory, the traction in bed is repeated, and the patient again allowed to go about after a few weeks.

Case 1. — Mrs. W., aged fifty-seven years, came in March, 1883, with the history of trouble in the left hip joint, of two years' standing; but she stated that she had had some tenderness in several joints for four years. The trouble began in her right shoulder, and had affected the elbows, wrists, right ankle, and one finger. The toes never got sore, and the fingers were not deformed. She stated that her general health had been good, but she looked delicate and rather older than she was. The tenderness and pain in the joints had never laid her up, and she had felt well throughout. About two years before she had stepped into a hole

and hurt her foot, and for the past year had limped with the left leg. During the summer of 1882 she began to have difficulty in going upstairs, and to feel weak and have pain in the anterior thigh muscles on motion, and stiffness in the left limb. She had noticed soreness in the left groin for two weeks, but had always supposed the pain to be due to muscular rheumatism, and never suspected that the hip was affected, until told by her physician, two weeks previously.

On examination, tenderness, crepitus, and limited motion were found to a greater or less extent in several joints, noticeably in the right elbow and both wrists. The left thigh was considerably flexed and adducted, and there was a coarse crepitus at the hip joint. She was very helpless, walking with difficulty. She was put to bed with long counter-traction splint and eighteen pounds' extra weight for six weeks, and then allowed to go about on crutches, with a jointed supporting splint, ("Dows'"), which took the weight off the joint.

The condition of the hip improved slowly but perceptibly from the start. Soreness became less, and position and motion at the hip improved. In the winter of 1884–1885 she was walking readily around the house without crutches. The following summer (1885) she went to Richfield Springs, and took the apparatus off to take the baths; she found she could walk so well that she did not put it on again. When I saw her in November, 1885, she walked very nicely, and had extensive motion at the hip in all directions, with very little tenderness. The condition of the other joints seemed no better; crepitus, stiffness, and tenderness were about the same as before. In a letter just received, her daughter writes, in answer to my inquiry: "We think mother quite as active as any member of the family; a little lame, but so much better than we ever expected to see her, [we] do not notice the limp. . . . She is very comfortable as far as the rheumatism will allow; her hands are quite weak and somewhat out of shape."

Case 2. — Mrs. R., aged fifty-eight, came in February, 1883. She was a large, strong, young-looking woman, had always had excellent health, and her family history was good. Eight years previous to coming the patient noticed that the right foot was

rotated out; when she turned it in, it caused pain on the inside of the knee; this pain also came when she got fatigued. It gradually grew worse, and for the past four or five years she had given up one duty after another, owing to lameness and increased pain. She had always supposed the knee to be at fault, and neither she nor her doctor had ever suspected the hip. For two years past she had been obliged to put a pillow under the right knee in order to be able to sleep, and the knee had received electrical and other treatment.

Examination showed the right thigh considerably flexed and adducted. Mobility at the hip almost gone, except flexion and extension through a few degrees. She never had pain except when tired; then it came on outer aspect of right knee; when she was still more tired, in anterior part of thigh, hip, and back. She had a moderate lameness. The functions of the knee were normal.

The patient was put to bed with the long hip splint, sixteen pounds' extra weight, and sling, for a month, during which time the thigh muscles relaxed, flexion was reduced, and pain was latterly absent. She was then allowed to get up on the jointed supporting splint ("Dows'"), and in a few days was walking nicely with the apparatus only, and feeling no pain.

The patient did well, but had on a few occasions some recurrence of pain, and once was put to bed for two weeks with counter-traction as before. In January, 1885, the apparatus was removed, and she was discharged cured, walking easily with but slight limp; position of limb almost normal, mobility increased. When last seen, over a year after her discharge, she got around very readily and comfortably, having retained what she had gained.

These results have been sufficiently encouraging to warrant the belief that many cases of intractable senile coxitis may be much relieved, and a limb useless for locomotion restored to comfortable use by a plan of treatment such as the one described.

Discussion.

Dr. Bradford stated that he would like to add his testimony in regard to the usefulness of Dr. C. F. Taylor's Dows' or convalescent

splint in the stage of hip disease when practicable recovery had taken place, but the joint needed protection against unusual jar to prevent recurrence. As illustrations he could mention two cases of hip disease in adults of twenty-five (one complicated later with phthisis), where after a couple of years of active treatment the hip disease had been substantially arrested, — by the aid of the convalescent splint the patients were able to take up active duties, and had been for a couple of years; were able to take long walks of several miles, and though able to dispense entirely with any mechanical support, yet preferred the protection of the convalescent splint if there was any demand for more than ordinary exertion.

Dr. G. B. Packard, of Hartford, Conn., said he had been greatly interested in hearing the reports of cases of senile coxitis. In this class of cases that came under his observation he had not been able to benefit them much, but he saw no reason why they should not be benefited by mechanical treatment. He would certainly try it in the future. He had resorted to almost everything. He had the impression that the joints were stiffer, and really worse, from applying splints, but should judge that the traction splint applied for a few weeks as Dr. Taylor suggests and then followed by a protection splint might be beneficial.

Dr. Taylor, in closing the discussion, said: "I have little to add to what I have said in my paper. I merely desire to call the attention of the Association to the fact that cases of senile coxitis can be benefited by using a plan of treatment similar in principle to that employed in other forms of arthritis of the hip joint, but modified to meet the special indications for treatment presented by this affection."

HÆMATOMA ORIS AS A SIGN OF INJURY TO THE SPINE IN THE SUPERIOR CERVICAL REGION.

BY BENJAMIN LEE, A.M., M.D., PH.D., PHILADELPHIA.

Alienists are familiar with a curious lesion of the auricle which it rarely falls to the lot of other practitioners to see. This consists in a gradual swelling up of that organ, non-inflammatory in its nature, slightly painful and sensitive or not at all so, which, as it progresses, destroys completely the natural shape of the ear, obliterating all the convolutions, until it looks, as much as anything, like a great purple egg plum attached to the side of the head. After an indefinite period the tumefaction begins to diminish, the skin loses its tenseness, and shrivels, and the final result is a shrunken, seamed, and distorted member. Not infrequently the ear bursts and a considerable amount of blood is discharged. As to the cause of this curious pathological change, which is so well recognized that it has come to be called the "insane ear," authorities differ. They are in the main agreed that, as Hammond says in his "Treatise on Insanity in its Medical Relations," it consists of "an effusion of blood within the cartilage or between the cartilage and the perichondrium." But it has been claimed by a considerable number of observers, that its occurrence among the insane is simply due to brutality on the part of the attendants in asylums. This position is not tenable. Were that the case it ought to be seen much more frequently in ordinary practice, and especially among children, who more than any others are liable to cuffs on the ear.

Hammond considers that even if we suppose violence to be a frequent existing cause, we must admit that "the insane condition acts as a powerful predisposing cause."

Spitzka, in his work entitled "Insanity; Its Classification, Diagnosis, and Treatment," describes this affection under the

designation "Othæmatoma," and considers it "a collateral trophic disturbance." "It is generally admitted," he says, "that if violence is a factor in producing othæmatoma, it is a subsidiary one to the structural predisposition of the patient's tissues. Injuries which would fail to produce any noticeable reaction in the sane induce this peculiar condition in certain lunatics."

Both of these observers incline to consider the pathological change as local, confined to the tissues of the ear itself. Clouston, in his "Clinical Lectures on Mental Diseases," goes a step beyond this, pointing out the analogy which exists between "the gelatinous bloody contents of a Hæmatoma auris and the extravasation under the dura mater, in pachymeningitis hemorrhagica interna, a disease which is likely to occur in precisely the same class of cases." "No violence," in his opinion, "will cause such a condition of the ear, where the morbid arterial conditions for its formation do not exist." He attributes it to arterial degeneration in the branches of the carotid artery. The forms of insanity in the course of which this affection is most liable to occur are, (1) acute mania; (2) melancholia; and (3) general paralysis of the insane. It is noteworthy that its appearance is looked upon by the officers of insane asylums as of very grave import. Out of eighty cases observed by Clouston, only three of the subjects recovered their reason. Kiernan reported three recoveries out of forty-eight cases in which he had seen this complication, but stated in a later paper that all three were subsequently returned to the asylum.

My own conclusions are: (1) That this curious pathological condition is idiopathic, never traumatic. Of course, I do not deny the existence of a traumatic hæmatoma auris. It is seen in prize-fighters. But it has a facies and a history of its own. The same amount of violence would probably produce an extravasation of blood in the tissues of the ear of an insane person, but that would not be the "insane ear."

2. That the local tissue change which makes the extravasation possible is dependent upon a degenerative alteration in the nerve centre which controls the circulatory apparatus of the auricle, involving or not the larger arterial branches. It is difficult to conceive of a local trophic change taking place unless under

such an influence. A degeneration of the arterial system dependent on failure of nutrition of the coats of vessels should be general, not local. The fact that in all these cases a tissue change is going on in the nerve cells of the cerebrum, occult, if not demonstrable, affords ground for the supposition that such change may also be extending to the pons and even to the cord.

If it be admitted that these propositions are tenable, then the following corollary may be accepted as worthy of consideration.

That, supposing like degenerative action to take place in the nerve centre which controls the circulatory apparatus of any other distinct portion of the face, we should be justified in anticipating a like result; namely, an idiopathic hæmatoma in that portion, — the eye, the nose, the mouth, as the case might be. Reasoning in the inverse order, if we meet with a hæmatoma in any of these localities not traumatic in its origin, gradual in its progress, with a tendency to relieve itself by occasional hemorrhages, we have serious ground for suspecting that some grave degenerative process is going on either in the spinal cord or in a closely contiguous ganglion to which the circulation of this locality is in abeyance; so that this circumscribed circulatory lesion, in itself insignificant, may prove the key to the diagnosis in a case otherwise obscure.

History.

I first saw the little patient whose case suggested the previous remarks, August 10, 1887. It was a female infant, aged eight months. Its birth had been somewhat premature, and for the first two months of its life it was feeble, emaciated, and ill-nourished. Two months on the New England sea-coast, however, had wrought a wonderful change for the better, and she had become plump, ruddy, and vigorous, with every prospect of perfect health. About ten days before my examination of her, the baby coach in which she was sleeping had rolled off a porch about four feet high, head first. The nurse denied that she was thrown out of the coach, but a grazed bruise on the outside of

one thigh seemed to indicate that such was the case. When taken up her face was livid, and for a short time she was breathless. As soon as she recovered her breath, she began to scream violently and was evidently in great pain the remainder of the day. A physician who was called in, and who saw her in about two hours after the accident, thought he discovered some rigidity in the movements of the head. Since that day she had been peevish and irritable, with frequent spells of screaming; and her mother had noticed that lifting her and especially moving the right leg appeared to cause her great pain. Careful investigation failed to detect any irregularity of the spinal column, and the motion of the head appeared to be unimpaired. But there was apparent lengthening of the right leg of fully half an inch, flattening of the nates, and partial obliteration of the ischio femoral crease. There could be no doubt, therefore, of the existence of effusion in the hip joint; and from the rapidity of its accumulation, I felt myself justified in considering this to be serous in its character. I ordered the immediate observance of the supine posture, and placed a sand-bag on each side of the limb. Two days later I secured additional immobility of the leg by attaching a heavy lead sole to the shoe, which I kept on all the time. The effect of these precautions was decided diminution of the frequency of the screaming spells and longer periods of sleep. While waiting for the arrival of the splint for which I had sent to my instrument-maker in Philadelphia, I attempted to use extension by stitching muslin straps to the inside of the shoe and carrying them through slits on each side of the sole down below the foot to a weighted cord passing over the foot of the couch. The heel was so small, however, that it proved to be impossible to exert any considerable degree of traction in that way. On the 18th of August I applied a long splint, my own modification of Taylor's splint, attaching it to the limb by means of a long gaiter, instead of using adhesive plasters, which I desired to avoid on account of the heat and the delicacy of the child's skin. As soon as the weather became cooler, however, I abandoned this plan and resorted to the plasters, finding that I was unable to prevent the heel from slipping up. For the next three weeks improvement was uninterrupted. The child nursed

and slept well, and had little pain except when the splint was temporarily removed. She now began to be more restless again, and it was observed that she cried when the other leg was moved. On examination I found decided impairment of motion through the opposite hip, with pain on rotation and upward pressure. I at once applied the sand-bags and lead sole to this limb also, and, eight days later, put on the splint, attaching it by means of a clamp and thumb-screw to the hip band of the first splint, which in my instrument passes entirely around the pelvis. This was again followed by improvement. A few days later she bore the trip home to Philadelphia with entire comfort, being carried on a pillow. Some three weeks after the accident her mother noticed a slight swelling of the gum above the right central incisor in the upper jaw. This gradually increased, and as it did so, became of a livid purple color. Astringent applications seemed to have very little effect upon it. A strong solution of nitrate of silver reduced it slightly in size. It had no tendency to ulceration, nor did it seem painful, except at times when it would cause her to refuse her bottle for a few hours. After a time it showed itself on the inner side of the jaw as well, and extended laterally in both directions; and bulging down over the teeth completely hid them. Occasionally there would be a slight hemorrhage from it, which was followed by a reduction in size. By the first of December, both hips had improved most encouragingly. The legs were of the same length. Motion was perfectly free and painless, and she could draw them both up and kick with some little force. I removed the left splint entirely, and promised myself the pleasure of soon removing the right. Up to this time the supine posture had been carefully observed. But I now gave permission for the child to sit up. This was followed in a few days by most serious results. The attacks of screaming were renewed, sleep was much disturbed, appetite lost, and a certain amount of febrile action set up. It was evident that the upright posture caused her great pain, and it was also observed that the movement of the right arm was painful to her. A day or two later the power of motion in this arm became impaired. It was then remembered that occasionally, all along through her illness, movement of this arm had

been painful. On the 18th of December a careful examination convinced me that there was disease very high up in the cervical spine, possibly between the atlas and the skull. The shoulders soon became slightly elevated, and the left arm also began to lose power. Every attempt to place her in the erect position for the purpose of adjusting mechanical support induced paroxysms threatening convulsion, in which the face became livid and the respiration difficult. I therefore abandoned the effort for a time, and contented myself with keeping her flat on the back, with the head slightly lower than the shoulders and making extension upon the occiput horizontally, sometimes including the chin. This was maintained continuously, and manifestly added much to her comfort. Emaciation now progressed rapidly, and her face became excessively pallid and lips colorless. The tumor of the gums steadily increased, and hemorrhage became more frequent. Toward the middle of January a slight purple discoloration manifested itself below the left eye. A few days later the eye began to protrude, and it was evident that there was a hæmatoma of the orbit. Loss of power in the lower extremities was now very apparent. In order to employ more efficient extension I now applied a padded steel collar acting upon the occiput and chin. This was not well borne, however, and I soon removed it. Symptoms of meningeal inflammation, slight convulsive movements, alternating with stupor, and constant vomiting now supervened. As a last resort I made another effort to apply the spinal splint with an attachment for head extension. In order to do this, I placed the child face downward upon my knees and kept it in that position for possibly five minutes. At the end of that time it seemed as if all the blood in the brain had rushed into the face. It was streaming from the mouth. The turgescence of the gums was excessive. Both eyes were probulgent, the left frightfully so. I omitted to say that discoloration had also begun to show itself in the neighborhood of the right eye. It seemed as though all inhibitory power over the circulation had ceased, and the blood flowed simply in obedience to gravity. After this time the excessive restlessness abated, and there was little suffering, but the patient steadily sank, and death ensued within twenty-four hours.

The foregoing history appears to me to admit of but one interpretation. When the accident occurred, injury was sustained by the spine in the upper cervical region as well as by the hip joints. The absolute maintenance of the supine posture, necessitated by the latter lesion, kept the former in abeyance, and at the same time masked its symptoms. But as soon as the vertical position was assumed, it developed with great rapidity. The subsequent hæmatoma of the orbit is a sufficient demonstration that the affection of the gums had a central origin. Now, if, as I venture to suggest, the blood tumor of the gums was the result of the spinal injury, either directly or as accompanied by a laceration of a considerable arterial or venous trunk, it would have led me, had I been aware of its significance, to adopt means very early in the history of the case which might have insured a different termination. I have brought the instance to your notice, thinking that in the abundant experience of so many orthopedists similar observations might have been made, by collating which a new sign might be established.

Discussion.

Dr. L. Hall Sayre, of New York. — I have been greatly interested in the paper read by Dr. Lee; and while I have never seen exactly the condition of hæmatoma oris which he describes, I have a case in my mind which has been under my treatment for a number of years in which a good many similar symptoms are present. The case is that of a lady who some fourteen years ago received an injury of the spine in the lower dorsal region from jumping out of a wagon. She was treated for some two years for nervous affections before the diagnosis of spondylitis was made. She was paraplegic for some seven or eight years, but has recovered to a certain extent from that. She has had an abscess pointing into the intestines, which discharged a good deal of pus. The most curious lesion she has, and one which is unique in my experience and also the experience of those that I have spoken to about it, is that very frequently she has attacks of discoloration underneath the eyes, involving the chin, and sometimes the point of the nose, which would become almost perfectly black with extravasated blood, and it looks as if the tissues would slough. I have seen that woman in this condition for some three or four

months; then it would gradually disappear and the skin become normal. She has a serious heart lesion in addition to Pott's disease, and she has been subject for the last three or four years to intermittent attacks of exophthalmus of the left eye; she suffers from severe headache, involving the left side of the cranium, and during these attacks, which last from two to three days, the left eyeball becomes enlarged, so that it is impossible for the eyelids to become closed. As the headache diminishes the eye recedes and becomes perfectly natural. During all these attacks of discoloration of the face the surface underneath the discolored points is excessively tender, — hyperæsthetic, and that passes away with it. She has had an ecchymotic spot over the heart for the last three years. I mention this curious case, and would like to see if I can get some light on the peculiar pathology of the subject. I look upon it as a disturbance of the vaso-motor system from injury to both the spinal column and cord itself, as well as the heart lesion in addition.

Dr. Vance. — I have been deeply interested in Dr. Lee's paper, and would offer a possible solution of the condition. I have had several cases of the hæmorrhagic diathesis where the least injury would produce a marked hæmatoma. I recall one case, a blind boy coming from the mountains of Kentucky to the Institution for the Blind in Louisville, that I was called to see in consultation with the attending physician. The day before I saw him he had come in contact with an object, striking himself about the knee, and in less than twenty-four hours it was greatly swollen and painful from fluid that had accumulated in the synovial sac. I aspirated it at once to relieve this, removing a large quantity of blood. The next day it was the same way. It had refilled, and I aspirated it again a number of times before relief came. I have had that boy under observation for two years since, and time and again have I seen him with three or four horns (that is the only way to express it) jutting out from his forehead. I would suggest that possibly the case that Dr. Lee reports is due to a hæmorrhagic diathesis. I do not know exactly how to explain the hæmatoma about the mouth, except from injury to the spine, but I take it that the child was of a hæmorrhagic diathesis and the effusion in the hip joint was blood. The boy to whom I refer would not get a blow anywhere on the body more than five minutes before he would have these horns projecting from the surrounding surface fully two inches.

Dr. Samuel Ketch, of New York. — I would like to ask Dr. Lee, as a point of information, whether he satisfied himself that there

was no pre-existing lesion in the joints or in the spine prior to the accident.

Dr. Lee, in closing the discussion, said: "With regard to the question propounded by Dr. Ketch, I am quite confident that previous to the accident there was no lesion whatever. The patient's nutrition was good, and she was commented on as being the very picture of health.

"I have to thank the members for their courtesy in listening so attentively to my paper and for the suggestions offered. I intended to have made a study of the ultimate nervous distribution, which would be concerned both in hæmatoma oris and hæmatoma auris, in order to make the paper complete; but on account of numerous engagements was unable to do so."

TWO KNEE-JOINT EXCISIONS.

BY A. J. STEELE, M.D.,

Professor of Orthopedic Surgery and Joint Diseases, St. Louis Post-Graduate School of Medicine.

WITHIN the past eight months I have done two arthrotomies of the knee, which, while illustrating the two abnormal conditions for which excision is usually made, contain some points of such special interest that I deem it may not be unprofitable to briefly consider them.

One was a case of chronic joint trouble in a lad aged nine years, first observed in early childhood, preceded by an injury to the left knee. He had, previous to the operation, been under my observation for three years, during which time immobilizing appliances such as plaster of paris, sole leather, Thomas's and Judson's splints, patten and crutches, gave relief from pain, prevented flexion of knee and posterior displacement of tibia. The ung. iod. co., the hot douche, the rubber bandage, recumbency in bed with weight extension, were all successively and faithfully employed; but the joint remained swollen and hot, and painful if disturbed. At one time I tapped the joint, removing mixed pus and synovia, which afforded temporary relief only. The general health continued fairly good until latterly, when diurnal fever and impaired appetite and dull pain so manifestly reduced his strength that operative interference seemed imperative. So, in the early part of July last, at the Augusta Hospital for Children, I operated on the knee, expecting to do arthrectomy, — that is, removing only diseased tissues; but exposure of the joint disclosed such extensive destruction that the more radical excision was deemed best.

The patient was anæsthetized with chloroform, antiseptic precautions observed, the limb elevated until bloodless, then a rubber bandage carried tightly around the upper part of the thigh. A curved incision was made above the patella, concave

downward, the extremities of the cut extending well backward, the better to allow for drainage. The quadriceps tendon was divided and the knee-cap turned down. Flexion of the joint exposed its whole interior cavity; pus filled the space and extended well up in the pocket under the tendon, to gain still freer access to which the stump of the tendon was divided longitudinally. The interarticular cartilages had disappeared, the perisynovial tissue was thickened, the synovial membrane pulpy, fungous, gelatinous, and the ligaments softened. The curved scissors were used freely in clearing away the inner lining of the joint, and when they were not efficient the spoon was brought into requisition. Erosion of the cartilages and superficial caries of the bone ends had occurred to such extent that it was found necessary to saw off slices from both tibia and femur, and to remove the patella entire; some scooping out and tunnelling, especially of the tibia, was practised. No oozing of blood occurred, and no vessels were found to ligate. The infected tissue being all well cleaned away and the parts irrigated with the bichloride solution, the leg was extended, the bones brought into good apposition and pinned together by three steel wire nails; Chassaignac's tubes were carried out of the lower ends of the cut, draining the popliteal space, the interior of the joint, and the sac under the quadriceps tendon. Iodoform was sprinkled into the wound, and the cut edges brought together with interrupted gut sutures; more iodoform, then antiseptic gauze and cotton completed the dressing. Strips of veneering were bound on the limb to immobilize the parts, the extremity elevated, the rubber band removed from the thigh, and the patient put to bed.

Recovery from the chloroform was tedious, and after some hours it became evident from the discoloration of the dressings that considerable oozing was taking place. The wound had been dressed and the limb put up with the expectation of allowing it to remain many days; so I was loath to disturb it. But, the oozing continuing, attended with complaint of pain and with one or two degrees' increase of temperature, I removed on the third day all the dressings. The parts were swollen but aseptic. After irrigating and redressing the wound, a plaster-of-paris splint was applied to the limb, to the thigh above, to the leg

below, connected by a flat iron bar at the back, and the same in front of the knee, but curved or arched so that free access could be had to the wound and it dressed without disturbing the oneness of the limb. It was then swung from the ceiling, and thus made very comfortable for the patient. The dressings were renewed twice a week, there being a slightly colored oozing but no pus. The steel pins, two of which had been driven from below upward through holes drilled in the tibia, and one from above downward through the femur were readily removed, being loose about the third week. The head of one nail was lost in the wound, covered; but as the precaution had been taken to tie a carbolized silk thread to its head, no difficulty was experienced in finding and removing it. The drainage tubes, which had been shortened from time to time, were also removed during the third week.

At the end of the fifth week the plaster-of-paris splint was substituted by a silicate of soda bandage, and the patient allowed to be up on crutches with a patten on the opposite shoe.

Fig. 60.

Case 1. — Result of Excision for Strumous Arthritis.

Within a week after the operation the patient's general health improved, and has so continued up to this present, when he has gained greatly in flesh and is almost robust; nothing in the way of medicine being taken except the syr. hyphophos. co. The wound is healed except a spot the size of a pea on the inner side, which I believe to be superficial. The bony union seems firm, for he uses the limb with apparent impunity, though still wearing for safety crutches and two light side splints; no perceptible shortening is observed between the two limbs.[1]

The other case in which excision was done was that of a female, aged eighteen years, with firm ankylosis of the left knee at about a right angle. On making passive efforts at extension, a click or locking was observed. There was no inflammation,

[1] At this present time, Jan. 26, 1889, the patient's general health continues excellent, and the limb firm, straight, and useful.

swelling, or pain in the joint; the head of the tibia was somewhat displaced backward or upward; the leg was one and one-half inches shorter and in every way smaller than its fellow; the foot everted; general physical condition excellent.

Nine years previous the knee had been injured by a fall. No medical attendant was called, though great local disturbance resulted and the patient was laid up for weeks. The ultimate result was flexion and ankylosis. The patient gave an opinion that the knee had been broken; irregular contour of the part seemed to corroborate such view; however, the removed specimen does not show it, unless of the inner head of the tibia.

Last December, at the Post-Graduate School, the patient being etherized, I made a semilunar incision from one femoral condyle to the other, below the patella, the ends being carried well back to insure drainage; the flap was dissected up, and the joint exposed. Hæmostatic forceps were applied to bleeding vessels. The lateral ligaments were divided and disarticulation attempted; but unsuccessfully, as the patella was found firmly adherent to the outer femoral condyle, extending to and bound down to the tibia. The condyles were cleaned, and a flat saw used to separate them from the shaft; then the blade of a butcher's saw was passed behind the joint, and the articulating surface of the tibia separated by cutting forward. Thus the bones involved in the joint were removed *en bloc*. The limb was extended and fair coaptation of the cut surfaces had; the better to hold them together, two bone pins, a trifle more than one eighth of an inch in diameter, were driven from below upward through the tibia, holes having been drilled for the purpose, obliquely on into the femur, an inch of each pin being left projecting above the skin.

The hæmostatic forceps were removed, the exposed surfaces dried and sprinkled with iodoform, two drainage tubes placed at the most dependent part of the wound, the edges coapted with catgut stitches, and over the whole antiseptic gauze placed with absorbent cotton and oil-silk. The temptation was great to remove the redundant integument, but was resisted, as I believed in time it would be absorbed and contract down; it did however give trouble, as I may explain later on. The limb was raised

to a vertical position, and placed in a well-padded bracketed wire splint, as advised by Ashhurst, and so fixed with broad adhesive strips; the patient put to bed, and splint suspended from the ceiling.

Recovery from the ether was most happy, no nausea or headache resulting. During the first seven or ten days the temperature remained elevated two or three degrees, and the pulse increased in frequency. On several occasions pills of opium were required to allay painful twitchings or startings of the muscles of the limb. After the second day the wound was dressed daily with carbolized oil, dry dressings, and oil-silk. There was incidental swelling at first, which however soon subsided. The cut edges united readily; the stitches softened and disappeared. There was little or no pus at any time; as it or moist secretions seeped into the drainage tube, they were absorbed or mopped out with a cotton holder.

As to the behavior of the bone pins: At the end of three weeks the projecting end of one was found to be loose, and was picked out, bringing one and one-half inches of that beneath the surface. It had broken in two pieces, so that the distal half still remained. I did not apprehend trouble from this piece, as I believed it would soften and be absorbed. A few days later the second pin was readily picked out entire, having undergone slight disintegration. One drainage tube was removed at the end of three weeks; the others still later.

After six weeks the bracketed splint was replaced by plaster of paris, which, three weeks later, was substituted by a sole-leather splint, laced in front, accurately fitting the limb, having been moulded over a plaster cast; the bones were firm and in good line, and the patient gotten up on crutches. The general health, somewhat detoned by the long confinement, rapidly improved after she was up and about. The redundant integumental tissue of the upper flap from the pressure of the splint, overrode the lower flap, and broke away from its adhesions for an inch or more. This complication delayed the result, and prompted the wish that this too abundant skin had been removed. It was, however, overcome by being drawn back and into place with adhesive plaster.

The limb was found to be three inches short, due not only to the one and one-half or two inches of bone removed, but also to the previous shortening incident to non-use, and possibly to premature ossification of the upper tibial epiphyseal junction at the time of the joint injury. A patten equalized the limbs and rendered locomotion easy.

So soon as it was prudent for the patient to travel, she left us for her distant home. Some weeks after her arrival she wrote me that the scar where one of the pins had been driven in had become sore and broken open with matter discharging. I at once suggested that the piece of broken pin left in was acting as an irritant, and would spontaneously come away or have to be removed. Later information verified the truth of my opinion, for the fragment so presented itself as to be readily removed. It was sent me, and found to be considerably eroded. The opening closed and has given no further trouble. A letter received within the past month remarks: "I am getting along splendid; I limp but a very little, and do not use the cane but a very little, and I can walk pretty fast." On another occasion she enthusiastically expressed her gratitude for the relief afforded by the operation, and suggested how immeasurably preferable was her condition now to what it was formerly. Again she says: "When I walk slow you could not tell that I am lame; the only trouble I have is my ankle turning a little" (due to the long leverage of the patten).[1]

Fig. 61.

Case 2. — Result of Excision for Right-Angled Ankylosis.

Remarks. — As previously indicated, we have in these cases illustration of the two usual conditions for the relief of which excision is advised; namely, joint disease and ankylosis. And

[1] The specimens removed were exhibited to the Society, showing in the one case extensive erosion of the three bones of the joint, in the other case the adaptation of the bones to each other from their long fixedness in the flexed position, and the elongation downward of the condyles, especially the inner.

while they have met the same fate, they were alike also in having a similar beginning, similar in having the same tissue or structure primarily pathologically affected, inflamed, namely, the synovial membrane, — in the first case assuming the chronic pulpy form, extending ultimately to other tissues and resulting in destruction and suppuration; in the second case, acute and simple in character, proceeding to resolution, but with the usual accompaniment of flexion and fixation; — similar, too, in our belief that if early and persistent treatment, immobilization, had been instituted, useful joints would have been saved in either case. And the query may be put just here: Was such an heroic measure as excision necessary at the time these cases were operated on? Is this operation ever necessary or best? The profession is still divided as to its propriety and advisability. Individually I am markedly conservative, and do believe that while the substitution of excision for amputation, as practised by Sir William Ferguson and others, was a great advance and commendable, yet that, as the operation became familiar, the pendulum of excision swung out too far, and many joints were sacrificed that might have been saved. To-day they would be; for we diagnose them earlier, have a better knowledge of their pathology, more correct methods of treatment, and improved appliances. A reactionary feeling, even in England where a few years since this operation was common, has taken place. To illustrate this: Not long since I attended a meeting of the Abernethian Society, composed largely or entirely of St. Bartholomew's men. The subject of the evening was injuries and acute diseases of the knee joint. Short papers were read, and pathological specimens and therapeutic appliances exhibited. Cases present and past occurring in the hospital were referred to. The subject of excision received its share of attention, and was very generally condemned; the disease for which the operation had been made in some cases returning, and in other cases the limb becoming deformed and flexed. We observe that Mr. Marsh, one of St. Bartholomew's surgeons, is very guarded indeed in recommending this operation; doubtless he reflects the views of his school, as additionally shown in its Society proceedings. Nevertheless this operation has its place; there is a

time when it may be demanded. To recognize that and act promptly, is our duty.

Case 1 was rapidly going on from bad to worse, locally and constitutionally, under conservatism. Arthrectomy, arthrotomy or amputation, — one or the other was imperatively called for. Certainly not the latter; that might find place as *le dernier ressort*, if the others failed. The scraping we had hoped might do; but the advanced destruction, as inspection of the specimens will show, evidences that it would have been without avail. We regret the stiff knee; but better that and life saved, or far better it than a wooden substitute.

Could Case 2 have been otherwise relieved? Believing the ankylosis to be false, we tried gradual extension of the limb, but without effect, except to pain and disgust the patient. Could the patella have been subcutaneously detached and the limb forcibly straightened? We think not. Nine years in malposition had so changed the normal relation of the parts that it would have been impossible to have extended the knee. The hamstrings and fascia could readily have been divided; but the posterior and crucial ligaments were structurally shortened, firmly holding the bones in their new relation; and more than all, the condyles of the femur having been unopposed many years had grown downward, — from being circular they had become elliptical, pointing down, thus presenting an insuperable barrier to extension.

Mr. Marsh says: "When displacement backward and outward, combined with flexion, is considerable, it will be found extremely difficult, and in many cases impossible, to correct it, on account of the rigidity of the ligamentous structures at the back of the joint. This will still be the case, even when the hamstring muscles have been divided. In instances of long standing a further difficulty is that the articular ends of the femur and the tibia have undergone an alteration in shape, the front part of the condyles of the femur having become overgrown so as to overhang the tibia; while the upper surface of the tibia has become oblique so as to slant downward and backward. Under these circumstances, as soon as extension is attempted the bones in front of the joint come firmly into contact and lock against each other; and if force, either immediate or

gradual, is applied, the result is that the head of the tibia slips back into the popliteal space. In these unfortunate cases two courses are open: either the joint may be excised, and the limb thus straightened, or the tibia may be brought into line with the femur, the displacement of its upper end backward being disregarded. Of these two methods there is no doubt that excision yields the best results." [1]

Mr. Macnamara says that in some instances "the abnormal growth of bone has been due to deficiency in the controlling or compensating presence which the structures of the body exercise upon one another, in order to keep their nutritive functions properly balanced and the machine in perfect working order. An example of this principle, as Prof. E. Wagner remarks, is 'seen in the ordinary form of genu valgum, for example of bakers, which occurs through excessive growth of the internal condyle of the femur; this arises from want of resistance exercised from the corresponding portion of the tibia during standing for hours at a time with bent knees.' In the same way we explain the excessive growth of a tooth in one jaw when the corresponding one in the other jaw is absent." He further adds: "I may refer you to this specimen of the lower end of the femur taken from the knee of a girl who had suffered some years from disease of the joint. The upper end of the tibia was drawn backward by the hamstring muscles, and the lower articular surface of the femur, having been relieved from the pressure which in health would have been continually exercised on it by the tibia, had become hypertrophied.

"We can, therefore, readily comprehend the reason why we sometimes experience difficulty in rectifying the malposition of the limb produced from a long-standing disease of the knee joint. We may divide the tendons of the hamstring muscles, bands of contracted fascia, and break down the ankylosis which often exists in cases of the kind, and thus for a time bring the ends of the tibia and femur into apposition; but our efforts fail in keeping them there, and the leg gradually reverts to its flexed position on the thigh, the truth being the condyles of the femur have become hypertrophied anteriorly, and until we remove them

[1] Diseases of the Joints, p. 443.

the tibia necessarily slips behind the enlarged portion of the bone."[1]

Thus, if in our case we had divided all the resisting tissues and employed extreme force to straighten the limb, it would not, according to Mr. Macnamara's testimony, have remained. Again, there is danger in such attempts; the popliteal artery has been ruptured; and I once assisted in a case where both knees were straightened with force, and the patient died of tetanus on the third day.

Inspection of the specimen removed corroborates the above statement, and shows the wisdom of the plan we adopted.

A few words now as to the technique of the operation; and first, as to antiseptic precautions. In Case 1 it was strict, in Case 2 partial only, and yet both did well. Possibly, as a friend suggested in No. 2, there was no soil for the germs; the system resisted them. Still I am a firm believer in the advanced teachings of the day. It were a crime to omit any precautions that we believe would minister to a successful result. In the suppurating joint antisepsis was the more necessary; in the healthy joint asepsis possibly only was required. In bone surgery I have sometimes been afraid of the irrigator, lest matter be forced into the little bony canals.

Second, in anæsthetizing children I use chloroform, for adults ether; and if in the former one meal, and in the latter two meals are omitted preceding the operation, nausea and after disagreeable results are prevented.

Third, the limb was rendered bloodless in Case 1 by elevation, and kept so by the rubber band; and in Case 2 no precautions were used, the arteries being seized with the forceps as they sprung. In the one case there was troublesome oozing, in the other none; the error in the first case being that the limb was not kept elevated for twenty or thirty minutes after the removal of the constrictor, until firm clots had formed in the vessels. Dr. H. Lennox Hodge used the Esmarch bandage in excision of the knee in a little girl. The wound was dry when closed; but a few hours afterward, when the patient had become warm in bed, reactionary bleeding occurred and the patient died.

[1] Clinical Lectures, London, 1878.

Fourth, the simplest cut to expose the parts is made from condyle to condyle below the patella, the extremities carried well back for efficient drainage. Additional drainage can be had by transfixing the popliteal space. In arthrectomy the incision had best be made above the patella, the quadriceps tendon divided, and the knee-cap turned down. Thus access is had, not only to the articular surfaces of the joint, but also to the sac extending up under the tendon. After the cleaning of the joint the patella is turned up and the tendon stitched.

Fifth, as little bone as possible should be sacrificed; transversely the saw cut should be parallel to the articular surface, antero-posteriorly, obliquely downward; thus the cut tibial surface butts against the femur, and prevents posterior displacement, to which there is a tendency.

Sixth, the adoption of pins, the better to hold the bones in apposition, is advisable; they prevent displacement and stimulate the callus. It is possible that ivory pins well antiseptisized might be driven in and allowed to remain. This, however, was not my experience with the bone; it acted as a foreign body. If then the pegs are to be removed, steel nails are preferable, to be withdrawn after three weeks.

Seventh, if strict antisepsis has been observed, permanent encasing splints may be used, veneering, binders' board, metal, etc., with the intent of not disturbing the dressings under three or four weeks; but if access to the parts is desired, the bracketed wire splint of Ashhurst is convenient, or plaster of paris interrupted at the joint by metal strips may conveniently be applied. Comfort may be secured by suspending the limb. Later on, silicate of soda or leather makes a light and efficient splint while the patient is on crutches. The splint had best be worn for many months, as there is a tendency to flexion, probably due to the hamstrings, which, as the patient walks, contract. Might it not be well to tenotomize these tendons?

The results of excision of the knee in this country have been better than in England. Probably our material is better, less constitutional taint, and closer antiseptic precautions.

There are those who still openly assert that amputation were preferable. To such an authority says: "The surgeon's first

thoughts should undoubtedly be of excision, for when successful the result is immeasurably superior to the best results of amputation. The surgeon should choose excision, for by so doing, he will probably succeed in preserving for his patient a limb better than any artificial substitute."

In my early practice I had from joint diseases unfortunate and even fatal results where now I would expect lives saved and limbs useful. But even now in the spirit of our conservatism, cases will go on from bad to worse, owing to depraved constitutions on the part of the patients, or meddlesome interference on the part of friends, or the cases apply when so far advanced that arrest is impossible ; then measures more heroic than orthopedic appliances find place. The knife and scissors and spoon and saw are called in requisition for the removal of what Nature would not transform; and now, with our antiseptic procedures, we adopt operations and undertake with assurance cases that would have been fatal in the past, and we now assure results that before were only hoped for.

Discussion.

Dr. Whitehead, in opening the discussion, said: "I think the usual curved incision made in front for the removal of even large pieces of bone generally unnecessary, especially in partial resections of the knee joint. I will attempt to show this in my paper. An external incision is sufficient to enable the operator to remove the necessary amount of diseased bone by means of chisel, bone-gouge, and saw. Another point to be observed is to respect the ligaments in operations about the knee joint. This is being done in France, but I cannot recall the name of the operator. Contrary to the usual practice, I have left the patella in place with good results."

The President called upon Dr. Lewis A. Sayre to participate in the discussion. Dr. Sayre said he regretted hearing only a portion of the paper, and was therefore unable to discuss it thoroughly.

Dr. Ridlon would like to ask Dr. Steele whether in the use of the Thomas splint which he mentioned in the first case, he used traction, in connection with it, from the knee down.

Dr. Lewis Hall Sayre. — I fully agree with Dr. Steele as to the propriety and advisability of exsection in this class of cases

in preference to amputation. There is only one class of cases in which I think amputation is justifiable for deformity of the knee. I had two cases, both occurring in children fifteen or sixteen years of age, where the injury took place when they were five or six years old. There was dislocation with flexion of the leg backwards. The condyles were much hypertrophied, the leg had not grown, and there was, as near as could be estimated, seven inches of shortening. In these two cases I amputated at the knee joint, leaving the patella in between the condyles and making the cicatrix entirely posterior. That is about the only condition in these cases in which I would favor amputation rather than excision of the joint. In other respects I am totally in accord with Dr. Steele. I think that these cases, in the first place, should have the benefit of the best mechanical treatment, — traction, counter irritation, compression, fresh air, and the best tonic and therapeutic measures. In case they go on from bad to worse, I certainly would favor excision, and would not wait until the joint had become entirely destroyed.

Dr. Steele, replying to Dr. Ridlon, said the patient (Case 1) had been in bed with extension and weight for weeks, but without arresting the disease. The Thomas splint was used, but not with an extension addition.

In Case 2, in regard to leaving the patella, the knee was bent at a right angle and had remained so for nine years; thus the adhesions were so firm that the bones were so misshaped that it was necessary to remove the patella to straighten the limb.

He had had no experience with the external incision alone, but feared it would not give all the access he desired in such cases.

Dr. Ridlon said he would like to offer a word of explanation to his former question. When in Liverpool last December, he found Thomas using traction in connection with his knee splint, by adhesive plaster applied below the knee, in those cases where there was flexion at the joint; and he was under the impression that he used traction in this way in all his cases of knee-joint disease while there was flexion. Further, he believed that Thomas kept his patients in the horizontal position until flexion had been overcome, and much of the tenderness and muscular spasm had subsided.

AN EXPERIMENTAL STUDY OF FIXATION AND TRACTION IN THE TREATMENT OF HIP DISEASE, WITH THE DESCRIPTION OF A SPLINT.

BY ROBERT W. LOVETT, M.D., BOSTON.

It is virtually agreed among American orthopedic surgeons that the best results in the treatment of hip disease are obtained by the continued use of the long traction splint described by Davis, Taylor, Sayre, and others. Englishmen, however, do not take the same view; and their opinion is voiced by Mr. Marsh, who says, in speaking of the American splints: "These splints, however, after having been fully tried, have been very generally discarded by English surgeons on the grounds that not only is it impossible to maintain extension (that is, to prevent intra-articular pressure) with them, but that they do not secure adequate fixation to the joint." [1]

On the American side the opinion has been freely expressed that the American splint furnishes fixation to the joint by virtue of the traction exerted.[2] In any event, the surgeon using the splint should surely know whether or not he is using a fixation splint,—a point which seems to be still an open one for discussion; and the following simple experiments were made to determine how much fixation is furnished by the ordinary Taylor Hip Splint when walking is attempted.

The problem was to register in some way the motion between the femur and the pelvis, if any such motion took place when the patient walked wearing a Taylor Hip Splint; and for this purpose the shaft of the splint was extended up by an adjustable appliance two or three inches and terminated in a clamp carrying

[1] Howard Marsh, Diseases of Joints, Lea Brothers, 1886, p. 407.

[2] Medical Record, Sept. 1, 1867, p. 290; Bauer's Lectures on Orth. Surg., N. Y., 1868, 2d ed., p. 282; Medical Record, Jan. 12, 1878, p. 27; N. Y. Medical Gazette, April 17, 1880, p. 243; N. Y. Medical Journal, July, 1882, p. 17; Medical Record, June 26, 1880, p. 738.

a pencil at right angles to the skin, which touched the skin, covering the ilium just below its crest. It was evident that if the leg and the pelvis moved as one, if there was no motion at the hip joint, that the pencil would record on the skin only as a dot. If, however, motion took place between the leg and the pelvis in the slightest degree, that motion would be registered as a line on the skin over the pelvis by the pencil attached to the splint, indicating the arc of motion at the hip joint that the leg had described in walking.

A Taylor Hip Splint of the ordinary pattern with one perineal strap was used in these experiments.

This registering appliance was first fitted to the hip splint of a boy thirteen years old who had ankylosis of the left hip joint, the result of former hip disease. In two experiments the pencil recorded only by a dot when the boy walked about freely and sat down and got up again, showing well enough that where there was no motion at the hip joint the register on the skin gave no arc, and that incidental errors were of little account, such as might arise from a rotary movement of the splint around the leg, caused by slipping of the perineal band over the tuberosity of the ischium.

A splint fitted with the register was then applied to a boy ten years old whose hip joints were perfectly normal, and the traction exerted was measured by two spring balances inserted in the plaster extension, one on each side. A traction of three and a half pounds was then exerted by means of the ratchet extension, and the boy was made to walk freely about. It was found in three experiments made under these conditions that the register on the skin showed that the hip joint had moved through an arc of 35° in the simple act of walking. In sitting down and getting up again about the same amount of motion was caused at the hip joint. These experiments were confirmed by a similar one upon an older boy with a normal hip joint, where 40° of motion were found to take place.

In the case where 35° of motion took place with three pounds and a half, the traction was increased up to eight pounds, when it became almost unbearable, and the boy could only be induced to endure it for a very few minutes. When walking was at-

tempted with this amount of traction (which was much more than any patient could endure continuously), the hip joint described an arc of 15°. This was determined by three experiments made on the same boy.

With regard, then, to a Taylor Hip Splint with one perineal band, these experiments show plainly enough that it furnishes very incomplete fixation to a healthy hip joint with any endurable degree of traction, and consequently to a diseased joint it must furnish equally poor fixation.

An experiment upon the same boy was then made with the original form of Taylor splint as now used at the New York Orthopedic Hospital and Dispensary, which has a rigid waistband encircling the pelvis, and two perineal straps instead of one; and when walking was attempted with that, very much better fixation was obtained, although it still lacked a very little of being complete. But it was not by virtue of the traction exerted that the hip joint was held so firmly, because just as much fixation was obtained when no traction at all was exerted as when the leg was pulled upon by a force of four or five pounds. The fixation at the joint seemed to be due to the rigid band holding the pelvis and the long leg shaft holding the leg.

So far, then, as the experiments go, the practical points shown are these: That traction in itself furnishes very incomplete fixation, and cannot be regarded as in itself a means of *fixing* a diseased hip joint in the treatment of hip disease; and that a Taylor Hip Splint with a rigid pelvic band and two perineal straps furnishes much more complete fixation to the joint than the newer form of the splint with only one perineal strap.

So far I have meant to speak of traction only as a means of fixation, not as a therapeutic measure. How it accomplishes its wonderful results in hip disease it would be hard to say; it does not seem likely that it separates the surfaces of the joint, in the early stages of hip disease at any rate. Experiments with a view to determining this question made upon the cadaver and upon patients under ether do not reproduce the clinical conditions, because muscular spasm, the most important factor of all, is left out of account. Consequently conclusions should be

drawn very carefully from these experiments as to what traction mechanically accomplishes in acute hip disease. Koenig and Paschen found slight separation, experimenting upon the cadaver and using traction of eight pounds and more; but Morosoff, on the other hand, was unable to produce separation of the joint surfaces in some experiments that he made with less than sixty pounds. Lannelongue,[1] by frozen sections, demonstrated a partial separation of the joint surfaces in a case of well-marked hip disease with an extension of ten pounds.

But when muscular spasm is present the conditions are changed, the muscles are all set in tetanic contraction, pulling the head of the femur against the acetabulum. A rough attempt to estimate their force was made in the case of the ten-year-old boy upon whom the hip-splint experiments were made. With the anterior thigh muscles, in flexing the thigh, he could exert twenty-four pounds' pressure as registered by a spring balance; with the posterior thigh muscles he could exert a force of twelve pounds, — a total of thirty-six pounds' force exerted voluntarily by all the thigh muscles. If these muscles were all set in tetanic rigidity to pull the head of the femur against the acetabulum, they would work at better advantage than in the experiment, and it does not seem likely that they would exert much less than thirty-six pounds' pressure. To antagonize this we have a traction force at the most of eight pounds exerted upon the loosely movable skin. If any weight at all can be attached to the experiment described, it does not seem likely that the traction splint produces distraction of the joint surfaces.

No attempt is made to underrate the wonderful value of traction as a means of treatment in hip disease; simply to point out that traction alone does not serve to produce fixation and probably does not separate the joint surfaces, and to advocate the view that in connection with as complete fixation as possible it finds its best application in the treatment of hip disease.

Leaving aside altogether the question of whether fixation (as complete as can be obtained) is desirable in all cases of hip disease in addition to traction, certain cases must occur in the

[1] Lannelongue, quoting Koenig, etc., Coxotuberculose, Paris, 1886.

experience of every surgeon, where complete rest to the joint is imperative. To put such children to bed for any length of time is always unfortunate. Dealing, as we are in most cases, with a tuberculous process, the maintenance of a good general condition is of the utmost importance, and confinement to bed shuts off the exercise, cuts down the appetite, and in general seems to handicap the patient. Knowing that certain hospital cases under my own observation were growing worse while wearing a Taylor Traction Splint with one perineal strap, because incomplete fixation to the joint was afforded in cases where the activity of the patient was uncontrollable or the disease very acute, an attempt was made to find some apparatus which would practically eliminate motion at the hip joint at the same time that it exerted traction, and this splint was adopted (see Fig. 62), which is merely a modified combination of the English Thomas splint with the American Taylor splint.

Fig. 62.

In the last few months it has been used in a large number of cases of hip disease coming to the out-patient department of the Children's Hospital, and with very satisfactory results. It is not presented as a splint for the routine treatment of hip disease, but as a means of furnishing fixation and traction in bad cases while the patient goes about on crutches. It possesses these advantages, — it necessitates the use of crutches; it makes it impossible for the patient to climb fences and knock about in the way that so many children do with such disastrous results; and it makes it possible for a child to go comfortably about even

with a joint exquisitely sensitive to every jar. It is clumsy, and for a while patients are much bothered about sitting down; but they learn to sit sidewise, and cease to mind the splint.

It possesses one further advantage in the treatment of deformity, — it can be bent to fit a limb, however much it is flexed, and can be gradually straightened as the muscular spasm relaxes without necessitating confinement to bed; and in a similar way adduction and abduction can be corrected by bending the splint laterally to fit the limb in its malposition, and gradually bringing it back to a straight line as the spasm relaxes under the influence of traction exerted in the line of the deformity.

The splint shown in the diagram is for the right leg. The chest piece A B is made to open by a hinge at the back, and when closed in place is buckled across the chest. C is an arm for the perineal band, running in the same place as the perineal arm of the Taylor splint. D and E are the regulation thigh and calf pieces of the original Thomas splint. From the outer end of E the foot-piece runs down below the foot, and ends in the ratchet and key arrangement for producing extension in use in the Taylor splints. The splint is applied, the perineal band adjusted, and the traction bar tightened last of all.

Discussion.

Dr. L. A. Sayre. — How much motion did you get in your cases when they got well?

Dr. Lovett. — My experience with the splint has not been sufficiently long to know the ultimate results. The splint which I showed the Association is made less rigid than the one I use in treating patients. It is merely a model.

Dr. Bradford stated that he feared the interest in the general subject of treatment of hip disease might make us overlook the special value of Dr. Lovett's valuable investigation of one point in the treatment of hip disease; namely, how much and how little fixation could be furnished by the distraction splint.

The value of the Taylor-Davis-Sayre splint when properly used is well known clinically, but its precise mechanical efficiency has not been always clearly understood. It may, therefore, be in prac-

tice misused, and the benefits attained attributed improperly to one mechanical principle, when strictly due to another.

Precision in the use of orthopedic appliance is desirable, and Dr. Lovett's paper will be a help in our understanding of exactly what we are doing.

Dr. B. Lee, of Philadelphia. — The proof of the pudding is in the eating. If our results in America in the use of traction, pure and simple, are inferior to the English results, obtained by fixation without traction, then it behooves us to acknowledge it. If we treat our cases here and obtain results with traction which cannot be obtained in England with fixation, then we will do well to adhere to it. My own view of the evil of fixation alone is so decided that I should deem it the greatest possible misfortune in the early stages of coxitis to put an instrument on my patient which would insure fixation, because I should fear that as a result I might have ankylosis of the joint. Twenty years ago, perhaps, I treated a very typical case in Philadelphia in a little boy. There was every possible sign, as recorded in text-books, of the disease, including abscess, with free discharge from several openings. That boy grew up to manhood; three or four years ago I presented him to the Medical Society of Pennsylvania. A committee was appointed to examine him. The chairman of the committee was Dr. De Forest Willard, who is himself a firm believer in fixation as far as it is possible to obtain it. He reported the case absolutely cured in every respect; that there was not only symmetry of the limbs, but perfect motion in the joint up to the point of almost complete flexion. In fact, so nearly normal was its condition, that he said to me privately that he was almost inclined to question whether the disease had not been extra-capsular. I do not remember another case of the same severity and as far advanced in which I obtained the same perfect result; but I have had many cases, taking the disease in the early stage, with free motion and symmetry as a result of treatment, and these results were obtained without the use of fixation, except as it may have been involved in traction.

Dr. Roswell Park, of Buffalo, said it occurred to him that Dr. Lovett had given the Association a valuable method for testing splints, and if any one desires fixation it can be attained by such a splint as had been exhibited.

Dr. Moore. — When I first began to treat cases of hip-joint disease, I was far away from instrument-makers. If a case came to me from a thousand miles, I would have to wait sometimes two

months to get an apparatus from New York; in the mean time I improvised what I could, and usually with satisfactory results. Dr. Thomas speaks, I believe, of extension as the American idea.

I have seen the workings of the English idea (fixation) in their own country, and we must admit that they get good results. I am convinced that they get ankylosis no more than we do. I think the appliance that has been exhibited is well worthy of trial.

I must say I am rather in favor of fixation, because whenever inflammation exists, the quieter the patient is kept the better the case progresses. Since I have been employing the Thomas splint with extension in a few cases, my patients have greatly improved; motion has increased, and the cases are doing well.

Dr. Lovett, in closing the discussion, said he was afraid he had been misunderstood. His paper dealt not with fixation alone, but with fixation in addition to traction. In the use of the Thomas Hip Splint alone, he had almost always been obliged to apply traction afterwards. With regard to the criticism of Dr. Bradford, it seemed to him that it required very great muscular force to fix a hip joint absolutely and rigidly, and that experiment in these cases would show that the voluntary muscular force exerted must be much the same as in reflex muscular spasm. He thought Dr. Sayre had misunderstood him as to the amount of traction used. He was never in the habit of using more than five or six pounds.

THE OPERATIVE AND MECHANICAL TREATMENT OF SOME JOINT DISEASES AND INJURIES;

With especial Reference to the Hip, Knee, and Elbow Joints; with Illustrative Cases. With twelve Illustrations.

BY W. R. WHITEHEAD, M.D. (PARIS),

Of Denver, Colorado; Ex President of the Colorado State Medical Society.

I. CONCERNING HIP-JOINT DISEASE, ETC. — I know of no deformity in which the proper use of tenotomy is so much ignored, and in which a more unreasonable use of braces is resorted to, than in hip-joint disease; and this, I believe, results from an inattentive consideration of the pathology of this disease. I have repeatedly met with inflammation of the coxo-femoral articulation in which the first thing thought of was the use of a brace or extension splint, without any regard whatever, apparently, to the contracted condition of the muscles about the hip, or of the flexion of the thigh on the pelvis due to effusion into the joint; or even of the atrocious pain caused by the grating together of eroded joint surfaces. In such cases there has evidently been an attempt to fit a crooked and painful limb to a straight splint without any benefit, and with much suffering to the patient.[1]

The following are some cases that I shall relate as examples of this attempt to fit a crooked limb to a straight instrument.

Fibrous ankylosis of the hip joint; tenotomy; brisement forcé. — Harry S., aged eleven years, was seen by me with Dr.

[1] I wish here to record my protest against immobilization alone in the treatment of hip-joint disease. I have been successful, as have Sayre and others, in curing this disease with motion, indeed with perfect restoration of the function of the limb; and I regard attempts generally to obtain a so-called cure of hip-joint disease by ankylosis, as a retrograde movement in surgery and as such unworthy of imitation, as entirely opposed to a sound and well-established principle of the treatment of inflamed joints by extension and counter-extension rightly applied. To impart motion judiciously to an inflamed joint, as its inflammation subsides, is a most rational act on the part of the surgeon, and the action of a suitably constructed traction brace is to perform this office.

P. V. Carlin, of Denver, during July, 1887, who saw him for the first time some weeks previously. The boy had limped more or less for two or three years, complained of his left hip, and especially of his knee; had scarlet fever, and some months afterward measles, and complained of pain on the inside of his knee during the scarlet fever. About a week after the subsequent attack of measles, which was in January, 1887, his left leg drew up. Later he was seen repeatedly by a practitioner of Denver, some time during the spring of 1887, who proposed a hip splint, and measured him for it. This doctor applied a weight and pulley to his left leg for three or four weeks. On questioning the parents of the boy, it was discovered that the doctor alluded to made extension without placing a pillow under the thigh, and making traction "in the line of the deformity;" in other words, extension was made without any heed to the pathological condition, in violation of the anatomical arrangement and physiological action of the muscles about the hip, and necessarily with the pelvis more or less tilted to compensate somewhat for the faulty use of the extension weight. The parents said the leg would hurt him in the night, and often the extension weight would be found on the floor in the morning.

Oct. 6, 1887. The patient having been etherized by Dr. W. W. MacGregor, then of Denver, now of Glenwood Springs, Colorado, I did tenotomy of the rectus femoris and adductor longus muscles; and after sealing hermetically the little wounds of the skin and bandaging the groin, I did *brisement forcé* at the hip, and restored mobility to the joint. Ice-bags and extension weight applied, with the thigh slightly flexed on the pelvis. Saw him each day; there was no notable rise of temperature.

Oct. 23. He was etherized, and forcible movements of the limb were made; ice-bags to the hip and groin, and after a few days the parents were properly instructed how to make motion at the joint, which they did well and with excellent results.

Nov. 13. Applied hip splint; my modification of the Sayre-Shaffer hip brace, made for patient by Tiemann & Co. (see Fig. 61). Subsequently good movement about the joint; brace discarded and patient cured.

Another example of an attempt to fit a crooked limb to a straight splint has already been published by me in the "Transactions of the Colorado State Medical Society" of last year (1887), and is the case of Katie M., in which *brisement forcé* was done and subsequently successful restoration of the functions of the limb was established and maintained; the same can be said of my case of *brisement forcé* published in the "Medical Record" of Dec. 18, 1886.

In these cases I have referred especially to the utility and desirability of *brisement forcé* at the hip joint when properly practised and afterward suitably managed by the use of extension weight and ice-bags to the hip and groin; the neglect of which would make of *brisement forcé* a most formidable undertaking. A most remarkable case of this kind I have yet to relate.

Fibrous ankylosis of the hip joint from hip-joint disease; tenotomy and brisement forcé during pregnancy. — Miss ——, aged nineteen years, had fibrous ankylosis of the right hip joint from hip-joint disease, which first developed itself seven years previously. I first saw her Dec. 13, 1887. She was a fine-looking, well-developed girl, except about the right hip and right lower limb, which were atrophied and the limb was shortened. No abscess had ever opened about the hip or groin; the disease was caused by a blow received on the hip; the general health had most of the time been good. There was some soreness occasionally about the hip, which was considerably elevated, with adduction of the thigh, eversion of the foot, and an apparent shortening of three and a half to four inches.

Dec. 19, 1887. Extension weight of nine pounds and elevation of the foot of the bed; thighs flexed on the pelvis with a pillow under them; extension weight did no good, except to relieve the slight soreness about the hip.

Dec. 26. I did tenotomy of the rectus femoris and adductor longus muscles, and also *brisement forcé* after thorough etherization by Dr. W. W. MacGregor. The snapping and cracking of the adhesions were distinctly audible at a distance; in fact, the adhesions were most thoroughly broken up, and perfect mobility of the previously ankylosed hip joint accomplished.

No appreciable prominence of the abdomen was observed after

straightening the limb, and neither Dr. MacGregor, myself, nor the woman attendant, her relation or connection, who assisted us, suspected her condition of pregnancy at the time, and everything passed off satisfactorily, even to the subsequent fitting of the brace by the instrument-maker about a month later.

Extension weight with thighs flexed and pillow under them; ice-bags to hip and groin.

Dec. 28. Morning temperature, 99.5° F.; evening temperature, 101.3° F. Very sore about the hip. More explicit directions given about the use of the ice-bags; restless, antipyrin as a sedative.

Dec. 29. Evening temperature, 101.2° F.; antipyrin. After this the temperature was at no time above 101°, and gradually, in a week, it became normal.

Afterward I practised daily, or caused to be practised, motion of the hip under proper care; and soon she was ready for the hip brace, which was applied by the instrument-maker in my presence about one month after the *brisement forcé*. She was remarkably straight, and the result of the treatment as good as could be wished for. She required a raised cork sole to her shoe of one and a half inches, which was the extent of the shortening.

I saw her repeatedly afterward, and on March 5, 1888, applied fresh plaster and bandages to her limb, and enjoined the use daily of motion of the joint. I lost sight of her for a while, and my instructions were to notify me when the adhesive plaster and bandages required changing.

About May 15, 1888, I heard that she had just been delivered of a child at full term, much to my surprise, as well as to that of her aunt or relative, who up to the time of the labor pains was ignorant of her condition; besides, this woman, her relative, had during a part of her life been a nurse.

The lordosis of hip disease would, in the first place, and during the early period of pregnancy, have diverted me from the suspicion of pregnancy in a young but deformed girl whom I had no reason to suspect of such a thing. This case, however, is a strong argument in favor of *brisement forcé* under suitable after-treatment; and is brought forward entirely with a view to

support this operation as a valuable resource in the treatment of fibrous ankylosis of the hip joint. Of course, it takes considerable time in such cases to give to the limb that strength and development which rubbing and the use of the limb will gradually produce. This is not understood, or there is an indifference to this fact on the part of those concerned; there has been neglect of motion, and further treatment has been declined, with no appreciation of what was done.

As examples of mechanical treatment of hip-joint disease, without tenotomy or other operative measures, I beg to refer to a few cases treated by the extension weight and pulley, followed by the continuance of this at night, and during the day by the use of the brace which I use and which I have already mentioned, — that is, my modification of the Sayre-Shaffer hip-joint splint; and which I thus described in my article on hip-joint disease in the "Medical Record," of Dec. 18, 1886 (see Fig. 63 of this traction hip splint recently made for me by Tiemann & Co., and exhibited to the Orthopedic Association): —

Fig. 63.

"I wish to claim nothing for this splint except that it is a useful combination of other instruments, and I believe will be found to answer a better purpose than some of those in use. This instrument differs from the Shaffer hip-joint extension splint in not having the weight of the body deflected from its straight course along a bent or bayonet-shaped bar of steel to the sole of the foot, and which causes the bar to bend under the weight, and the foot to tend to turn inward.

On the contrary, the force exercised by the weight of the body is decomposed, and transmitted solidly downward by two vertical rods of steel to the small horizontal rod under the sole of the shoe; and around this small rod the shoe turns to permit flexion and extension of the foot. The rest of the instrument is arranged for extension and other motions, like Sayre's short splint for the treatment of hip-joint disease. The Shaffer spiral spring is made strong enough to keep the weight of the body from stretching the adhesive straps, which are designed solely for extension at the hip joint. This spring can be loosened or fastened, and moved up or down for an inch or two or more, by means of the same key that is used to extend or rotate the limb."

But the ball-and-socket joint at the hip makes this rotary movement of the instrument in its shaft unnecessary, and adds to its expense. It is made by Tiemann & Co., of New York, and by Mr. Brittain, of Denver.

The first example of purely mechanical treatment that I shall cite is that of a consumptive with hip-joint disease, in which there was only improvement of the local hip trouble, without any permanent benefit; but which, however, satisfactorily establishes the utility of proper treatment in the worst cases: —

M. M., aged thirty years, laborer, was sent to me by Dr. J. C. Blickensderfer, of Denver, with disease of the right hip joint. Patient came to my office, Dec. 6, 1887, on crutches, was very weak, and much emaciated, and in addition to his hip disease, is phthisical. The pain about the hip was excruciating, and he was in great terror of being touched. Allowing him to undress himself at his leisure, and to take a position on a blanket spread on the floor, I astonished him and soon gained his confidence by gently and suddenly seizing his right thigh with my left hand while the same arm supported his left thigh, and lifted him from the floor, making extension while so doing "in the line of the deformity." The poor fellow, who a minute before was terrified out of his wits at an attempt to touch him, at once became quiet, and exclaimed, "Oh, that feels so good!" If we owed nothing else to Sayre, it would be a lasting tribute to his memory, — the fact alone of his having shown us how,

without pain, to handle a patient with hip-joint disease; and this poor suffering patient's exclamation was an eloquent prayer for extension in hip-joint disease.

Dec. 7, 1887. Applied adhesive plaster, and extension weight of nine pounds, raising foot of bed — motion made at regular intervals.

Jan. 25, 1888. Ready for splint; had bed-sore; set him up in bed to take pressure off of sore; ordered splint for him of Tiemann & Co.

February 17. I fitted splint to him, and afterward repeatedly saw him walking about in his splint comfortably.

On June 3, 1887, a little boy, F., with hip-joint disease of left hip, aged three and a half years, of Boston, visiting Denver, was brought to me by its parents. The child was put to bed with extension weight and pulley, and the mother instructed in the use of extension in the proper direction; and being very intelligent, she aided me well, so that in less than a week the child was ready for the brace, the contracted tendons not requiring tenotomy. The brace was applied June 7, but there was some trouble with it, as it frequently needed repairing; and soon the child left for its home, and is now, I believe, under the care of an orthopedic practitioner of Boston.

As another example of the care required to prepare a patient with hip-joint disease for the traction splint or brace, I shall cite the following case sent to me by Dr. Carlin, of Denver: —

"A. M., aged five years, had hip-joint disease of the left hip, distinct, but in an early stage of development. Believing that hip-joint disease in its earliest periods may sometimes be cured by simply resting in bed with an extension weight to the limb, I confined this child to bed. The improvement was so great, that after a few weeks I omitted the extension during the day, and relied on extension at night alone. Soon she became lame again, and I ordered a splint for her of Tiemann & Co. For some reason, while waiting for the splint to be made, neither during the day nor at night was extension applied; and when the splint came, the limb was so contracted that it was necessary again to confine her to bed for two weeks with extension weight, before the soreness had sufficiently left the joint and

the limb had become straight enough to use the brace, which was Sept. 5, 1888."[1]

This preparation for the use of an extension brace is, indeed, generally a very simple matter, but often requires tenotomy, and sometimes *brisement forcé;* and it is the neglect of such preparation that causes failure in the use of the traction brace. There are cases, however, which do well, and relapse because the brace is discarded too soon. There are others, also, in which a scrofulous vice causes a return of the disease in the same joint, or its appearance in both joints. I have had two such cases under my care within the last two years, in which, after getting very fair results, and indeed nearly curing the disease in one of them, it has hopelessly returned and in both joints.

As examples of operative treatment without mechanical appliances, I beg to refer to the following cases. The first is one in which it appeared to me quite impossible to use to advantage any apparatus for producing extension.[2]

The case was that of a child of F. R., of Denver, aged fifteen months. May 10, 1888, this male infant was brought to my office; his thigh was very much swollen, flexed on the pelvis, and adducted; the hip elevated and the limb shortened. At first, however, it was extremely difficult to determine that the hip joint was diseased; but it was easily perceived that a large abscess existed in the upper part of the thigh. The general condition of the child was good, with no discoverable history of its having received a blow or injury to the hip; yet the disease was of recent origin. Dr. J. E. Lowery, of Denver, having given him chloroform, I opened the abscess, made a suitable counter-opening, washed out the abscess cavity with Thiersch's boro-salicylic acid solution, and dressed it with antiseptic materials. The dressings were repeated a few times, always using iodoform liberally; at first packing the wound with iodoform gauze. After a few weeks, the wound seemed to have healed altogether; the treatment being merely palliative.

[1] Nov. 9, 1888. It was necessary to do tenotomy of the rectus femoris and adductor longus to prepare the limb properly for the splint, which was done to-day.

[2] Bradford's method, with the child fastened on a light horizontal frame, might answer the purpose.

About eighteen months or two years ago, Mr. T., a prosperous German, a farmer, living near Denver, consulted me about his son, who had a stiff hip, the result of hip-joint disease. I proposed *brisement forcé*, which was declined, and the boy was taken to Europe for treatment.

June 1, 1888. This boy, aged eight years, returned to me, the parents stating that he had been under the care of Von Esmarch at Kiel, after seeing me, and that Esmarch had done an operation on the hip, and removed a small piece of bone. An extensive scar over the trochanteric prominence was the site of the distinguished German surgeon's operation, which was an excision or an osteotomy. An abscess had formed on the outer side of the thigh near the hip some months after the operation, and it was for this abscess that the parents of the boy again consulted me. Dr. Lowery having given chloroform to him, I opened the abscess and, making a counter-opening, washed it out and dressed it as in the preceding case. June 8 and 11 it was redressed; on June 19 it was well, and remained so to the time I left to attend the meeting of this Association.

This treatment suggests to me a plan that I have adopted in the management of abscesses about the hip joint, and which I believe may obviate the necessity of excision in some cases in which the bone is not extensively diseased. When an abscess forms about the hip, open it, wash it out thoroughly with boro-salicylic acid solution, finally with a very weak mercuric bichloride solution, in a child; then put into the wound a piece of damp gauze well filled with iodoform, and firmly twisted into a cord; this acts as a drain; then seal the wound with antiseptic precautions. I have found one dressing of this kind nearly to heal an abscess, and two quite heal it.

The diagnosis of hip-joint disease may sometimes be quite difficult, in cases of hysteria or neuroses of this joint; but generally the main diagnostic symptom may be stated to be pain in the hip joint, and confined to it, and manifested on proper manipulation; rheumatism being always a multiarticular affection. In children, however, it is sometimes difficult to decide.

April 30, 1888. Dr. Carlin called me to see a case which simulated hip-joint disease in a peculiarly striking manner, and in which he recognized an abscess about the hip in a boy aged ten years; the thigh was flexed, adducted, and the hip raised. After a careful examination of the hip joint and the head of the femur, which I moved freely in all directions, and without pain on firm pressure, I decided that the joint was not diseased, and that the abscess did not communicate with it. Dr. Carlin having given him chloroform, I opened the abscess, which was situated underneath the gluteus medius muscle, and near to the joint, but having no communication with it.

The above case was one easily mistaken for hip-joint disease. There was an abscess near the joint, and only the most careful examination could detect the absence of disease of the joint. But in marked contrast to it is the following case, which exhibits either extreme carelessness or ignorance of the pathology and symptoms of coxo-femoral inflammation.

J. C. D., aged thirty-two years, consulted me, Oct. 12, 1887, for what he was told was hip-joint disease. About two months previously, he fell and hurt his hip, and was confined to bed four weeks at a hospital, and was treated by a competent young physician for a contusion about the hip. On questioning this patient, who still complained of some stiffness of the muscles of the hip, he said that at no time since the receipt of his injury was he obliged to hold his thigh flexed on his pelvis to rest easily, and that he could always lie comfortably flat on his back, with both legs extended, without arching the lower part of his spine. In no stage of hip-joint disease can this be done, as we all know. My examination of him, while he was lying on a smooth, hard surface, confirmed his statement, as his back and both popliteal spaces touched this surface at the same time, and he was quite comfortable. The femur was freely movable in its hip socket without any pain on pressure, it mattered not in what direction this pressure was made. His case, it seems, had been properly diagnosticated and treated at first; but doubting the correctness of the opinion of his first medical attendant, he sought the opinion of one whom he believed to possess considerable skill and reputation as a surgeon, and who gave him

a certificate, of which the following is a copy; the original certificate is in my possession: —

DENVER, Sept. 13, 1887.

This is to certify that the bearer, —— ——, has some of the symptoms of the incipient stage of hip-joint disease, and needs careful and long-continued treatment for it, otherwise he will be a cripple for life.

(Signed) —— ——, M. D.

On the opposite side of the paper on which the above was written, is the following supplementary expression by another medical man: —

I am certainly of the above "opinion."

(Signed) —— ——, M. D.

The patient told me that this doctor made no examination of him whatever.

Of all injuries to the hip joint, an old dislocation of this part is possibly the most interesting, especially since the introduction of Bigelow's method of reduction of dislocations at this joint.

July 9, 1888. Dr. Carlin asked me to see J. M., aged thirty years, laborer, or rather miner, and came with him to my office for this purpose. The doctor thought, as I did, that possibly the dislocation might be reduced, notwithstanding its long duration. There was an upward and backward dislocation of the right femur of fourteen months' standing; the shortening was two and a half to three inches. Measured by Bryant's ilio-femoral triangle, the upper border of the trochanter major, the patient lying flat on his back, corresponded to a vertical line drawn from the anterior superior spinous process. The head of the femur rested on the dorsum of the ilium above this line.

Some days later, at the St. Joseph's Home (Sisters' Hospital), I attempted a reduction under ether; five successive efforts were made in strict conformity with the Boston surgeons' method, and each time as the bone reached the rim of the acetabulum it unavoidably slipped back to its misplaced position. The attempt at reduction was consequently abandoned, and a cutting operation, under strictly aseptic precautions, was proposed, but

declined by the patient. It was proposed, Dr. Carlin readily assenting, to make an extensive straight vertical incision over the trochanter, *liberate the muscles attached to the upper part of the femur by division close to the bone, as I have done in subperiosteal resection of this joint, scoop out the acetabulum with Volkmann's sharp spoon*, and put up the limb in an immovable plaster-of-paris bandage, and afterward at the proper time begin passive motion, *with extension*, at the joint; all of which would involve the most careful antiseptic precautions, and subsequent judicious care of the case.[1]

II. Cases of Partial Excision of Knee Joint, to correct Angular Ankylosis, etc. — In the first of the two cases of partial excision of the knee joint which I shall report, it was wrongly believed that the patella was joined to the condyles by fibrous adhesions only, and it was proposed to break loose the patella, and after thorough division of the hamstring tendons and adjacent fascia, by open incisions, to straighten the limb by *brisement forcé;* then, by the use of a back splint, extension weight, and graduated movements of the joint subsequently, to restore mobility gradually to the joint.

About two years ago, with the same object in view, I attempted to straighten both contracted knee joints of a lad about eighteen years of age. Previous attempts to effect this had been unavailingly made, by mechanical means, at an orthopedic establishment, as well as by different physicians, and I thought that by the aid of the subcutaneous section of the hamstring tendons, I should be successful; but I quite failed to straighten either

[1] I confess that I had, at the time, no knowledge whatever of any attempt ever having been made to reduce an old dislocation at the hip joint by cutting down on it, though acquainted with other dislocations reduced in this manner. I simply proposed to carry out what my judgment dictated to me, under aseptic precautions, to be a practical and rational operation, of which I was willing to assume the responsibility. In the discussion which followed the reading of Dr. Ashhurst's paper on "Excision of the Larger Joints," before the American Surgical Association at the Congress of American Physicians and Surgeons, Sir William MacCormac, of London, related his successful experiences in the excision of the hip joint for old dislocations. After the detachment of the muscles about the femur in my proposed operation, and the reposition of the head of the femur in its acetabular cavity, made ready for it, I cannot, at present, see any advantages of excision over this new operation.

limb, which I thought, erroneously at the time, was due entirely to an imperfect division of the fascia by a subcutaneous operation. Consequently I determined that in future I would not rely on subcutaneous division in such cases, but resort to open section, under aseptic precautions, by which means I could cut the fascia to better advantage, and surely be able to straighten the limb.

In the following case, the patient being etherized, it was found impossible by any properly directed manual force to budge the patella, and an operation was deferred. In the mean time the following paragraph from the last edition of Stephen Smith's work on "Operative Surgery," p. 840, 1887, met my eye: "If the joint has long been bent at a right angle, not only do the structures above the joint contract, but the condyles lengthen, so as to render it impossible to bring the tibia down to its proper position, even by dividing the resisting tissues, as the hamstring tendons; in such cases the extremities of the condyles have been cut away successfully with antiseptic precautions." This is quoted from Lister. Hence, at my second appointment, I went prepared to exsect a part of the condyles, if required, which was done and the limb straightened; and then it was perceived that without such exsection all attempts to straighten such limbs must prove failures; and the reason is this: The growth of the extremities of the femur and tibia necessarily occurs in the direction of their length; and if the joint has been a long time bent, the epiphyses of the bones, in such cases, forming an angle with each other more or less acute, the articular surfaces adapt themselves to each other somewhat like the abutting ends of the rafters of a house. Hence Lister, as quoted by Stephen Smith, found lengthening of the condyles, in the long-bent position of the knee joint, to interfere with straightening of the limb, and resorted to partial excision, which I did also successfully in the two cases which I now propose briefly to report.

Case 1. *Ankylosis of knee joint; partial excision.* — Nov. 3, 1887. Charles B., aged thirteen years; ankylosis of right knee joint of several years' duration; unsuccessful attempt to dislodge the patella, which was firmly united by bone to the femur. Further attempts were deferred to a cutting operation. Present:

Drs. H. A. Lemen and P. V. Carlin, of Denver. Fig. 64 shows appearance of patient before the operation.

Fig. 64.

Nov. 9. Partial excision of the knee joint. Open section of the hamstring tendons as a preparatory measure to straightening the leg. It was then discovered that the joint surfaces abutted together in such a manner, that to straighten the leg was quite impossible without a partial excision of the joint; and this was made still more apparent after the joint sur-

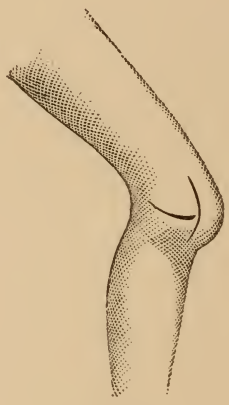

Fig. 65.

faces were exposed to view. An incision was made on the external side of the joint, as shown at Fig. 65, along and below the external border of the patella, and an incision at right angles connected with this below. The patella was detached from its bony union to the femur, by means of saw, chisel, and mallet; *but the patella was not removed;* Drs. H. A. Lemen and Carlin assisting me. Sufficient bone was removed — which I here exhibit to you — through the external cut to permit the limb to be brought to a straight position, when the knee was dressed with antiseptic precautions and put in a wire splint, with extension weights applied, and ice-bags put to the knee. *Care was taken not to divide the external lateral ligaments or any of the ligaments*

about the joint. The average temperature for the first week was 99.5° F.

Nov. 24. Changed dressing and removed drain-tubes.

Nov. 29. Changed dressing; wound nearly healed.

Dec. 10. Dressed wound, and substituted plaster-of-paris splint for wire splint.

Dec. 18. Removed dressing; cured; continued, however, to wear a splint to support the knee and secure firm ankylosis, which afterward took place.

March 14, 1888. Patient was photographed.

Fig. 66 shows a wood-cut from a photograph of the boy; exhibiting also on the outer side of the leg, opposite the knee joint, the scars of the incisions; and more posteriorly the scar of the lower drain tube hole.

Fig. 66.

Case 2. *Ankylosis of knee joint; partial excision.* — Edward L., aged eleven; fibrous ankylosis of right knee joint; joint free from inflammation; patella firmly united to condyles by bony union.

Operation, Jan. 31, 1888. Partial excision of knee joint.

Fig. 67, a wood-cut, from a photograph taken before the operation, shows the appearance of the knee and right leg at that time; the boy's general condition being excellent.

Preparatory section of the hamstrings, and popliteal fascia by open incision; assisted by Drs. W. W. MacGregor and J. E. Lowery; the latter gave the ether. Operation done, as in preceding case, *by an external incision, and the ligaments were respected — that is, were not cut — and the patella was left in place,* and the same kind of after-treatment as in the preceding case was adopted, with the exception that hydronaphthol as an antiseptic was used exclusively in the dressing. *Extension and ice-bags to the joint,* as in the preceding case. The extension during

the first week or two allays pain by controlling muscular spasm, and, in conjunction with the ice-bags, keeps down inflammation, even in those cases in which there is no hope of obtaining motion in the joint subsequently; and in this way extension is a valuable aid in the treatment.

Fig. 67.

Fig. 68.

February 2. Temperature, 100° F.; it subsequently fell to 99°, and was this on an average during the first week.

February 14. Changed dressing; inserted a rubber drain-tube; some suppuration; knee swollen; the hydronaphthol gauze caused considerable irritation; he said it burnt him immediately it was applied. Discontinued hydronaphthol dressings altogether, and two days afterward returned to my usual dressings of mercuric bichloride and iodoform.

February 16. Changed dressings; rubber tube acting well; used dressings of mercuric bichloride and iodoform.

February 22. Changed dressing; large ulcerated surface around the drain-tube holes; inflammation exterior to the joint, which is doing well; removed drain tube.

March 5. Changed dressing; ulcerated surface healing rapidly. After this I saw him quite often, and twice curetted the drain-tube holes, which greatly accelerated their healing.

June 11. Drain-tube holes all healed; and after obtaining his photograph, he was discharged cured, and he left a few days afterward for his mountain home in Middle Park, Colorado, wearing a splint to favor firm ankylosis of the knee joint. Fig. 68 shows a wood-cut of him after the operation.

July 25. Relapse. After leaving Denver he was exposed to a snowstorm in crossing a high range of mountains, and while camping, it snowed on him during the night. He was attacked with a severe cold and inflammation of the knee joint, and finally, after more than a month of suffering, was taken to Denver, where I saw him again July 25, in a most pitiable condition, — worn, haggard, with knee joint much swollen and intensely painful, and with a temperature of 103.5° F. Dressed his wound.

July 27. Having been removed to the Sisters' Hospital at Denver, Dr. Lowery gave him chloroform, and I opened the joint in several places, and made counter-openings above the knee, from which escaped about half a pint of the most offensive smelling, dark-colored pus. The wound was thoroughly irrigated with a mercuric bichloride solution, and injected with an ethereal solution of iodoform; and then a number of iodoform gauze drains, such as I have already described, were introduced, and the wound was sealed with antiseptic precautions.

August 5. Knee dressed as on the 27th of July; *doing splendidly and not a drop of pus;* temperature normal.

August 21. Changed dressing; slight suppuration; patient walking about with a crutch.

August 30. Dr. Lowery gave him chloroform, and I curetted the sinuses with Volkmann's sharp spoon; new felt splint applied.

September 7. Dressed wounds, aided by Dr. Lowery, who was

left in charge of the case during my absence in attendance at this Association.[1]

I believe that even after a knee joint has begun to assume a permanently angular ankylosis, which will eventually lead to a lengthening of the epiphyses in such a manner as to make them meet together like the joined ends of two rafters, as in the two cases just reported, much may be done to restore the limb to a normal position, as the following case will illustrate.

Case of scrofulous disease of the left knee joint of several years' standing; tenotomy; extension.—Feb. 1, 1888. Dr. John P. Kelly, of Golden, Colorado, called me to Golden to amputate a cancerous breast, and while there requested me to see a little girl, Jennie B., aged nine years, very much emaciated, and suffering with a painful scrofulous disease of the left knee joint. At the suggestion of Dr. Kelly, she was placed under my care.

Fig. 69.

Fig. 69 is a wood-cut engraving copied from a photograph of her, and exhibits her appearance before treatment. The patella was freely movable, and the joint was not ankylosed. There was a subluxation backward of the tibia, and the characteristic overhanging knee-cap and condyles, as shown in the engraving.

April 4. She was etherized, and, Drs. Clough and Lowery, of Denver, assisting me, I divided the hamstrings by open incision. After freely dividing the hamstrings and all contracting fascia, I could not entirely straighten the limb, owing, as I believe, to the pathological condition, mentioned above, already taking place in the joint. After the wounds in the popliteal space were sutured with catgut and sealed with antiseptic precautions,

[1] November 9. His condition is excellent; two small sinuses need curetting; he walks to my office to be treated; limb ankylosed in straight position.

I placed her in bed with an extension weight and pulley, after Sayre's method, but modified in this manner after a few days, because of excoriation of the calf of the leg. One pulley was put in the ceiling of the room immediately over the leg, which rested on a soft pillow, and there was just enough weight, about two pounds, attached to the pulley to support the leg gently, and to the webbing of the adhesive plaster attached to the sides of the leg were a weight and pulley to make extension in a line with the partially corrected deformity, after section of the hamstrings, but enough weight only to cause gradual extension and

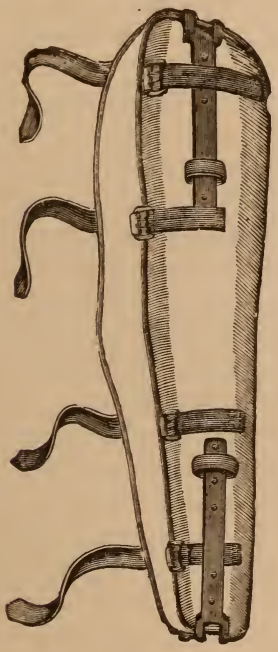

Fig. 70.

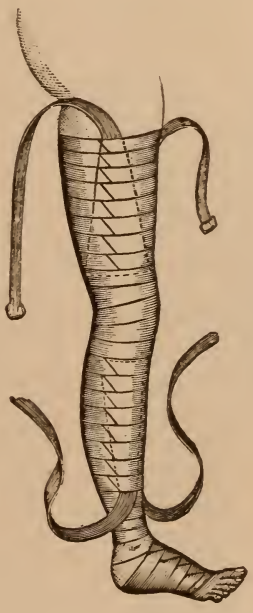

Fig. 71.

without pain, and the weight after a few days was slightly increased; and the line of deformity gradually brought to a straighter normal line as the case progressed toward cure, so that on May 13, 1888, I applied my new knee-joint extension brace with complete success.

It is so simple and comparatively so inexpensive, affords such complete relief, and is so easily applied by the mother of the

child or attendant, that I believe, when it has been once tried, that it will invariably give entire satisfaction for the purpose for which it is used,—that is, to procure relief from pain in making an easy, comfortable, and continuous extension and counter-extension of an inflamed and painful knee joint.

I must give the caution, however, which would hardly seem necessary, that before the use of this brace the limb must be made ready for it; that is, made straight by the appropriate preparatory treatment as in hip-joint disease.

Fig. 72.

Fig. 70 shows an engraving of the instrument from a drawing which I made; and Fig. 71 shows a drawing exhibiting the manner of applying the adhesive plaster above and below the knee joint, with pieces of webbing for making the extension and counter-extension. The dotted lines represent the adhesive plaster underneath the bandage.

The instrument is made in the following manner: Leather might be preferable, but a piece of Russian felt is moulded accurately to the leg and thigh; upright pieces of brass or light iron are riveted to each side of the brace above and below, as seen in Fig. 70, and at each distal end of these pieces of brass is a little roller, over which rolls the webbing attached to the adhesive plaster above and below the knee; thus extension and counter-extension are secured, and an elastic knee-cap and buckles fasten the apparatus about the limb, as seen in an engraving from a photograph of the girl taken about the 15th of May (see Fig. 72). To strengthen the instrument, a flat steel bar may be riveted along the back of it. Buckskin or chamois should be sewed along the edges, and the projecting points on

each side of the little rollers should be covered with chamois to prevent irritation of the skin.

In infants the manner of managing acute or chronic inflammatory diseases of the knee joint is confessedly difficult, and I believe the following successfully treated case worthy of brief mention: —

April 17, 1888. Dr. L. H. Wood, of Denver, recommended the parents of a little boy, aged eighteen months, to consult me concerning a subacute inflammation of the knee joint of several months' standing. I adjusted adhesive plaster with pieces of webbing attached to each side of the leg from just below the knee, and I bandaged the leg and thigh from the toes up. The child was chloroformed and a silicate of soda bandage applied over the first bandage; but while applying the silicate of soda bandage, firm extension and counter-extension were made at the knee joint, and the limb straightened as much as possible without undue force. The pieces of webbing, sewed to the adhesive plaster for making extension, were on each side of the leg just above the ankle left free. At night and during the day while the child was asleep, an extension weight and pulley were attached to the webbing, the bed being raised at the foot.

May 1. Substituted an adjustable felt splint, moulded accurately to the limb, for the silicate of soda bandage.

May 13. New dressing.

May 20. Dressing and new splint.

May 25. Ice-bags to knee, and their continued use for ten days or longer.

June 25. Dressing and new splint; saw him July 5 and 7.

July 14. Cured; all inflammation had left the joint, and he could move it freely without pain, and walk on the leg comfortably. As a precautionary measure, I advised the continued use of extension at night.

III. Resection of the Elbow Joint for Gunshot Wound. New Apparatus for Extension and Counter-extension at this Joint. — The management of the elbow joint, after resection, is a subject that has always more or less interested surgeons; and I think that the apparatus that I used in a recent case will commend itself to the use of military and civil sur-

geons. This instrument is equally applicable to the treatment of acute inflammatory diseases of the elbow joint in their earlier stages, as after resection.

Dec. 7, 1887. Mr. C., a deputy-sheriff, while attempting to arrest a desperado near Deer Trail, Colorado, was shot through the right elbow joint; and I here show you the bones that I removed by resection at night by lamplight, assisted by two cowboys, with other cowboys and deputy-sheriffs looking on. The

Fig. 73.

resection was done through a posterior longitudinal cut, which joined the two bullet-holes of entrance and exit. The wound was dressed with scrupulously antiseptic precautions; my cowboy assistants cleaning their finger-nails with a nail-brush, and scrubbing their hands and arms in repeated changes of hot water and soap in the most approved manner. The elbow and arm were adjusted in a felt splint, and some hours afterward he was removed to Denver and placed at the County Hospital, where I saw him every day or two. Average temperature, 99° F.

Jan. 6, 1888. Applied my apparatus for extension and counter-extension at the elbow joint. (See wood-cut engraving of him with splint applied, copied from a photograph, as shown at Fig. 73). The outside bandage on the forearm, that keeps the splint in its place, has been temporarily removed so as to show its action. The webbing for making extension passes over the little rollers at the lower end of the splint or brace, as seen in Fig. 74 at *a*. In the engraving, copied from the photograph of Mr. C., there is shown a loop of rubber tubing attached to the webbing on the outer side of the arm; the same arrangement exists also for the inner side of the arm. To each piece of rubber tubing is a chain, which can be caught at any link desired into a hook at each side of the brace near its bend at the elbow, as seen at *c* in Fig. 74.

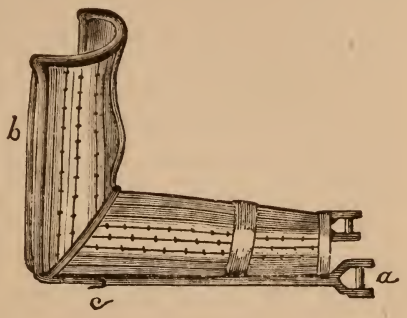

Fig. 74.

Application and action of the brace. — The forearm having been shaved, and a gauntlet bandage properly applied from the tips of the fingers to the wrist, pieces of adhesive plaster with webbing sewed to these are applied to the inner and outer sides of the forearm, and covered by a bandage from the wrist, joining with the gauntlet bandage. In the mean time the arm is held between pronation and supination, with the thumb directed upward. Traction on each side of the arm by means of the webbing, which is reflected over the little rollers at the lower end of the brace, pushes the whole brace backward, so that the upper vertical portion of the brace, padded and fitted to the front part of the arm, in pushing the arm backward, makes counter-extension at the elbow joint; while the pieces of adhesive plaster, to which the webbing is sewed and reflected over the little rollers, pull the forearm forward and make extension at the elbow joint. The brace is steadied and kept to its place by an outside bandage on the forearm. The brace is also secured by a bandage to the arm. In the use of this brace by Mr. C., ex-

tension and counter-extension at the elbow joint were accomplished in a most effective manner, and afforded him immediate relief from pain, and, indeed, made him perfectly comfortable, and facilitated the rapid healing of his wound. The instrument is a stout wire brace smoothly padded. In applying it a short felt splint or piece of pasteboard, lined with cotton batting, should be placed behind the arm just above the elbow, to prevent the bandage, which passes between the rod at *b*, in Fig. 74, and the brace, and then around the back of the arm, and also around the brace, from compressing uncomfortably the soft parts on the back of the arm.

Jan. 19, 1888. Mr. C. came to my office, and afterward was photographed.

Jan. 28. Wound healed; removed splint; he came afterward to my office to have passive motion practised.

Feb. 6. I broke up the adhesions, under ether, at the hospital; arm extended during one week in a straight position by means of adhesive plaster, weight and pulley; ice-bags to elbow joint.

Jan. 13. Removed dressing, and stopped extension in straight position; pronated and supinated and flexed arm thoroughly under ether; used extension apparatus, as shown in engraving from photograph, which afforded him the greatest relief and comfort.

June 20. I received a letter, probably written by his wife, expressing his gratitude, and saying that he was thrown from a wagon, hurting his arm, and that from this accident he had suffered more than from the gunshot wound. I have not heard from him since; but when he quitted me there was good motion in the joint.

In treating inflammation of the wrist joint, I think the new Russian felt, as made by Tiemann & Co., is preferable to the sole leather used by Sayre; and no delay in application is occasioned, as with the sole leather, waiting for it to dry; besides, the use of ice-bags is a valuable addition to the treatment. The following case is an illustration: —

April 27, 1888. Mr. S., of Denver, aged thirty, had acute inflammation of the right wrist joint, with the most atrocious pain;

applied Sayre's adhesive plaster method, and repeated the same, but with the quickly moulded Russian felt instead of leather; immediate relief; ice-bags to the dorsum of the wrist.

Discussion.

Dr. Lee, of Philadelphia, led the discussion. He said: We are greatly indebted to Dr. Whitehead for having come two thousand miles to give us the benefit of his experience in the treatment of these cases of joint disease. I suppose it is difficult for us with the facilities which we can command to appreciate the demand which is made upon the ingenuity and the presence of mind of a surgeon under circumstances existing in the far West. The paper embodied so many points, and there were so many cases reported, that a discussion of any one of them would be quite impossible for me at present. They presented many interesting features, and their treatment seemed to me to be generally founded upon sound principles.

Dr. Moore. — I must confess that I break up joints in a manner similar to Dr. Whitehead, but in a milder way. I have time and again seen evil results follow such breaking up of joints after old inflammatory conditions. I think that, instead of doing what Dr. Whitehead advocates in these cases, I would tenotomize and bring the joint in position as near as possible, and overcome the deformity at a later time by operation on the bone if necessary. I should not undertake to straighten the diseased joint in the manner that he advocates.

Dr. Phelps had discontinued the practice of breaking up a previously suppurating joint, because suppurative inflammation frequently followed, produced by liberating tubercular matter which had become encysted. He performed excision not only in this class of cases, but in many others even where suppuration had not taken place.

Dr. Ridlon. — I would like to call attention to one point. In the breaking up of these joints, if we have a joint where there is no tubercular disease, the risk can be little. But if the joint becomes ankylosed from tubercular disease, I should not advocate breaking it up.

Dr. Whitehead, in closing the discussion on his paper, said: I am glad to have an opportunity to reply to the remarks in op-

position to *brisement forcé*. This opposition results, I believe, from a very wrong conception of the manner in which *brisement forcé* is performed, and of the precautions required subsequently in the management of cases subject to this procedure. If rude and violent movements are inconsiderately practised, bad results may immediately follow attempts of this kind. We should carefully make traction on the limb at the same time that we move and support it, near its upper part. If, in addition to a neglectful after-treatment of simply relying on rest in bed, for the patient to recover from the effects of the manipulation, we should thoughtlessly during the breaking-up process grind and press forcibly the head of the femur against the head of the acetabulum, we would aggravate any inflammation which exists, and precipitate serious results, especially if no suitable after-precautions are taken.

Cases should, as far as possible, be selected in which there is fibrous ankylosis, and which are free from inflammation, and also in which the general condition of the patient is good. The opponents of *brisement forcé* seem not to think, and make no mention whatever, of the use afterwards of extension and counter-extension properly applied. This is a most valuable means to allay irritation about a joint; next to it is the use of ice-bags to the hip and groin, changed as required, and retained in position for a week, or until all, or nearly all, soreness has left the joint, when careful movements with extension may begin. Without such precautions we may expect failure; with them, in properly selected and properly managed cases, we may rely on having success.

IMMOBILIZATION IN ARTICULAR DISEASE.

BY V. P. GIBNEY, M.D., NEW YORK,

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THE foregoing title has been adopted for a discussion of the question whether fixation of a joint about which disease of the bones exist is detrimental, or contributes in the least to the permanent impairment of the functions of the joint.

This question has been for many years a most important one, and the statement has been made time and again, by both orthopedic and general surgeons, that any prolonged treatment of a joint which arrests the functions of the same is the chief factor in the production of ankylosis.

Upon this theory, splints for the protection of joints are constructed, and the American method of treating diseased joints is known as extension with motion.

The late Prof. S. D. Gross ("System of Surgery," p. 1091) says: —

"Protracted disuse powerfully disposes to the occurrence of stiffness of certain articulations, especially those of the fingers, wrist, and elbow. I am aware that the force of this influence has been denied, but certainly not upon just grounds; for experience has shown, and my own observation has repeatedly verified the fact, that this circumstance alone is often capable of producing ankylosis of a very obstinate and intractable character. Such an event need not surprise us if we remember that motion is the appropriate stimulus of an articulation, and that more or less of this is just as necessary to healthy action as food is to the stomach, light to the eye, or sound to the ear.

"When motion is suspended for any length of time the synovial membrane becomes dry and stiff, and, eventually taking on inflammation, pours out plastic matter, which effectually obliterates its cavity and so induces permanent ankylosis, on the principle that when the function of a part is destroyed, its structure is essentially changed in its character, if not completely annihilated."

This opinion from the Nestor of American surgery very fully embodies the views of the mass of surgical teachers in this country who have published any contributions to this subject. The existence of stiff joints that have long been subjected to disuse, whether by splints or by disease, I certainly shall not deny. The poetical argument that light is intended for the eye, waves of sound for the ear, etc., is all well enough in its way, but when disease invades these structures, Nature somehow seems to require rest for the tissues diseased, and she usually adopts means to prevent the action of these agents which in health are grateful and necessary; in other words, throughout the whole animal economy the function of an organ in health is modified in proportion to the impairment of that organ. The *consensus* of opinion, as expressed by the leading surgeons of New York City within the past two or three years, is to the effect that the best possible results in elbow-joint injuries are obtained by perfect immobilization after the parts have been placed in normal position.

I need only refer to the discussion following the reading of a paper by Dr. Henry B. Sands, of New York, on the "Use and Abuse of Passive Motion," and a similar discussion before the surgical section of the New York Academy of Medicine.

It is maintained, I know, that stiffness and prolonged impairment of motion often follow the use of splints, about the elbow and the wrist, where fracture or dislocation has occurred. The laity have become fully impressed with that idea, and marked confidence is displayed when Dr. B. tells them that Dr. A. has kept his splints on too long; and the Dr. B. who thus flippantly expresses such an opinion is legion. My own experience in the management of fractures and other severe traumatisms about joints is not large, I confess; still it enables me to state with assurance that the more perfect has been my immobilization, the less stiffness even have I encountered as a sequel.

Surgeons seem to lose sight of the fact, which is indeed a fact, that in the majority of these cases the inflammatory disturbance induced by the trauma is quite extensive, and not confined to the site of fracture. Surgeons, I am sure, will admit that the ordinary dressings do not secure anything like immobilization in

the strict sense of the term. One surgeon advocates the generous use of cotton batting, in order that subsequent swelling may not be an unpleasant complication; another pleads for temporary dressings, and seems like the first to be afraid of swelling. I am sure I shall not be considered captious when I assert that a great many surgeons take hold of an arm timidly, and do not know when the fragments are in correct apposition. He who knows when a deformity has been reduced has no hesitation in applying prompt and efficient dressings. In this day of snug surgical dressing the fear of swelling is not so great as it formerly was. We somehow feel that swelling can be controlled by a judicious use of bandages and by calling gravitation to our aid.

So much, then, for acute lesions about joints. Let us now consider the chronic and more insidious lesions with which we, as orthopedic surgeons, have to deal. When the pathology of the last generation was the accepted one, of course immobilizing splints were regarded with much fear. I do not believe that any one of my hearers to-day holds to the doctrine of primary joint lesion in what is ordinarily understood as Pott's disease, hip disease, white swelling, or caries of the ankle. This association, I am sure, subscribes to the osteitic origin of the above-named diseases. We profess to be able to recognize a chronic epiphysitis, for instance, long before any joint effusion or joint tenderness has occurred. Many of us have had the opportunity of studying bone symptoms, and then later on joint symptoms in the same case. The teachings of pathology in both hemispheres have established the correctness of this theory. Many of us, indeed, go a step further, and assert that the majority of these lesions are tubercular in origin. The progress of the disease, too, is toward the destruction of the bone. Inflammatory neoplasms do not occur except during the reparative stages.

In rheumatic lesions the opponents of immobilization find their strongest argument. The pathology of the disease is so different from that in the diseases we have been discussing that therapeutic agents might naturally differ. For instance, in rheumatism there is usually an increase of tissue. In that form known as arthritis deformans the increase proceeds directly from

the bone. If perfect quietude to the articulation could be secured, it is argued by some, resolution would take place, and one source of irritation at least, which seems to be the cause of increase of tissue, would be removed. Looking, however, upon rheumatism as a constitutional malady, it is difficult to see how the above argument holds good.

There are many good practitioners who maintain that an articular rheumatism is modified greatly by measures they secure for fixing the joint. It was not my purpose, however, to enter into a discussion of rheumatic lesions; but it was my purpose to construct an argument from the pathology and the clinical history of chronic articular diseases in favor of immobilization. Since 1884 I have applied plaster of paris to nearly every joint in the body. When in consultations I have advocated resection of a knee in an adult patient, who had suffered from childhood from white swelling, I have been urged to put the knee up in plaster of paris and get ankylosis as soon as possible. My experience in such cases has been simply this: the better fit I secured with my plaster dressing and the longer I have kept it applied uninterruptedly, the greater was my disappointment at not finding any ankylosis; in other words, the range of motion was increased by the prolonged fixation. At my clinics I have often had the opportunity of showing the class, by actual measurement, a greater range of motion in cases that had been long subjected to plaster dressings.

I have used the long hip splint without any motion at the pelvic band, not that I believe that the splint for this reason secures immobilization. With my friend Dr. Judson, I am convinced that the element of traction plays an important part in the production of fixation.

My cases that are convalescing, and those where I have dispensed with a splint, do not present ankylosed hips. It has been my custom also to employ the Judson thigh-clasp for securing better immobilization, and in this way the smallest degree of motion is permitted at the knee. Considering, then, the length of time the knee is kept at rest, there should be many cases of ankylosis at the joint; but I think my fellow-members of this Association will agree with me that, apart from a temporary

degree of stiffness which passes off with use, there are no ankylosed knees which can be traced to the use of the long hip splint.

Reverting to the pathology for a moment, we can understand how a protective splint — one which prevents pressure about the dense laminæ of bone immediately beneath the articular cartilage cells — is the best way possible to prevent ankylosis.

Mr. Macnamara, speaking of this dense layer of bone, says: —

"It is therefore constantly being renewed from the cells of the deeper layers of the articular cartilage. If such were not the case this lamina of bone would speedily be destroyed by the pressure to which it is exposed; and, if destroyed, the soft cancellated tissue of the bone would be laid bare, as it is, in fact, in certain forms of disease. Until this lamina of bone has been removed, either by the surgeon or from the effect of disease, it is almost impossible for the extremities of the bones forming a joint to grow into one another and produce bony ankylosis." (See Macnamara, "Diseases of Bones and Joints," London, 1887, p. 23.)

Mr. Reeves ("Practical Orthopedics," Philadelphia, 1885, p. 384), in commenting upon this spurious form of ankylosis, quotes Paget and Butler, among the English writers, Menzel, Reyher, Teiscier, and Jacobsen, as drawing attention to the danger of prolonged ankylosis. At the same time he says: —

"It must, however, be borne in mind, as pointed out by Jacobsen, that there are certain sources of fallacy which must not be overlooked; *e. g.*, in cases where prolonged rest has been necessitated by an injury to a limb, such as fracture or dislocation, the primary injury may have set up articular mischief which was unnoticed at the time; and I would add that there need not have been original injury to the joint, but changes may have extended to it along the periosteal or medullary vessels."

Mr. Thomas, of Liverpool, has analyzed some of the reputed cases of ankylosis after immobilization, and they certainly do not stand criticism well. In place, then, of tabulating a large number of cases where immobilization has been employed without the production of ankylosis, it would seem to me that the *onus probandi* rests upon those who assert that it does produce

ankylosis, and it is to such we must look for cases published in detail. In concluding this short paper let me state firmly my belief that whatever ankylosis occurs in a joint which has been subjected to immobilization, occurs by reason not of the immobilization, but of the nature and intensity of the inflammation and of the inefficiency of the apparatus employed. I do not lay any claim for plaster of paris in this argument, but I do maintain that this agent should be employed until we can substitute a better agent therefor.

Discussion.

Dr. L. A. Sayre, in opening the discussion, said that some years ago he was called to Kentucky to see a little boy, but being unable to go himself, he sent Dr. Bauer to take his place. At that time the limb was very much deformed, and the boy suffering great agony, especially at night. The doctor divided the tendons, brought the limb straight, and placed him in a wire cuirass, which immobilized the limb as perfectly as Dr. Thomas's splint does, but had the additional advantage of traction. Everything was immobilized except the arms. The boy was comfortable in the position in which he was placed. He was kept in this absolutely fixed apparatus for eleven months without being changed once, — the physician in whose charge he was left fearing to change him, as he was not confident that he could again re-dress him. When the bandages were removed he was not only cured of his hip disease by firm, bony ankylosis, but there was complete ankylosis in every joint on both sides of the body, — hips, knees, ankles, and the entire spinal column, although there had been no inflammation in any of the joints except the one hip, yet all were completely consolidated. I saw him some years afterwards, and was afraid to break up any of the tissues.

Mr. Brodie mentions a case of ankylosis, complete and perfect, as observed at the post-mortem examination, where there was no inflammatory action at all, but simply an arrest of the functions of the joint. Quiescence of the part caused absolute and complete consolidation of the same.

Dr. Ridlon. — Mr. Thomas, of Liverpool, told me that the case of Sir Benjamin Brodie, referred to by Dr. Sayre, was one of rheumatism, and that he had also seen the boy referred to in Dr.

Sayre's book, and that his was a case of rheumatism also, and therefore the ankylosis in each case was easily accounted for.

Dr. SAYRE. — Was Mr. Thomas ever in this country?

Dr. RIDLON. — No.

Dr. SAYRE. — Then he could not have seen my case, for the boy was never out of Kentucky, and therefore his testimony is good for nothing, — "Falsus in uno, falsus in omnibus." When Dr. Bauer placed him in the cuirass, he had perfect motion of every joint except in the diseased hip, and when he was removed from the same at the end of eleven months, every joint was firmly consolidated in both of his lower extremities, and the entire spinal column, from the sacrum to the cervical vertebræ, was absolutely incapable of being bent in any direction, and yet he had never complained of any pain in any of his joints during all these eleven months, neither had he had any fever.[1] I have seen many cases of ankylosis, more or less complete, from rheumatism, and have never seen a case that had not been accompanied with pain during the progress of the disease. I have myself been a martyr to this disease for many years, resulting in partial ankylosis of two of my joints, and can therefore testify from personal experience that it is always attended with severe and sometimes agonizing pain. As this boy had perfect motion in all his joints except the diseased hip when he was immobilized in the cuirass, and was perfectly consolidated in all his joints when removed from the cuirass at the end of eleven months, without having had *any pain or fever during all that time*, I claim that the *ankylosis* was due entirely to *immobilization*.

As to the case of Sir Benjamin Brodie, I think the profession throughout the world have as much confidence in his ability to make a correct diagnosis as they have in Mr. Thomas, and I must therefore believe him when he says his case was ankylosed from disuse without any intercurrent disease.

The principal objection to Thomas's splint is that there is no

[1] Dr. Ridlon desires to state, with reference to his discussion with Dr. Sayre, that after the positive assertions of Dr. Sayre he felt it his duty to ascertain from Mr. Thomas the facts in the case. To that end Dr. Ridlon wrote to Mr. Thomas, and from a personal letter, which it is not necessary to reproduce here, learned as follows: Some years ago Mr. Thomas saw, at the Adelphi Hotel in Liverpool, England, a patient suffering with rheumatic inflammation of all the joints with the exception of one hip joint, which joint did not exist, it having been excised by Dr. Sayre.

traction applied to prevent *interarticular pressure* from *reflex muscular contraction.* If this traction is properly applied, and in the right direction, moderate and limited motions can be given to the joint without any pain whatever, and the presence or absence of pain is my guide to the amount of motion given.

Plaster of paris will secure the joint as immovably as a Thomas splint; but unless accompanied by *traction,* will not prevent the destruction of the head of the femur and perforation of the head of the acetabulum by absorption, the result of constant pressure from the reflex muscular contraction. This contraction is what produces the usual deformities peculiar to hip disease; but when confined in the plaster of paris the usual distortion is prevented; but the destructive ulceration progresses just the same unless traction has been applied, and because the limbs are parallel, and the usual deformity absent may cause an error in diagnosis, as I saw some years ago in the case of young Gregory from Texas, in consultation with Dr. Tom Sabine. Dr. Sands and himself had applied plaster of paris to immobilize the joint for nearly two years; and simply because the limb did not have the usual distortion of advanced hip disease, and direct pressure of the femur upward did not aggravate the pain, Dr. Sands was positive that there could be no disease of the hip joint, but that it must be confined to some other portion of the ilium than the acetabulum. There was a very free discharge of pus from an opening above Poupart's ligament near the anterior crest of the ilium, which had been discharging for many months, and the boy was very much exhausted. Without the knowledge of Dr. Sands or myself, Dr. Krackowitzer was called to see the boy by Dr. Sabine (the older), in order to settle this difference in diagnosis. He made a slight incision behind the trochanter, and at once passed his finger through the perforated acetabulum, touching the other finger in the rectum, through the intervening intestine and soft tissues. This, of course, confirmed my diagnosis; and the following day I exsected the joint, removing a large amount of the necrosed ilium in the presence of the two Drs. Sabine, Dr. Krackowitzer, Dr. T. M. Markoe, Dr. L. M. Yale, Dr. M. Henry, and my two sons.

The boy made quite a rapid recovery; and six months after, I saw him riding a pony in the mountains at the Hot Springs in Virginia. I merely mention the case to illustrate the necessity of *traction* in diseased joints in addition to immobilization.

Dr. Lee said he hoped he had expressed himself sufficiently

clearly in the previous discussion as regards his belief in the danger of fixing the joint in cases of coxitis, and the importance of depending mainly, if not entirely, upon extension. He believed the danger of producing ankylosis in a joint by keeping it absolutely at rest to be a real one. The claim made by the author of the paper and by Mr. Thomas, that the ankylosis often found on removing the splints from a joint which had been fixed in order to treat an injury near it was dependent not upon the fixation, but upon an intercurrent inflammation of a curious nature, painless and unrecognized, or upon simultaneous injury to the joint, appeared to him simply skilful special pleading and begging the question. Certainly any inflammation or injury sufficiently severe to induce ankylosis ought to attract the attention of a surgeon of ordinary powers of observation; and yet it passes unnoticed until the splints are removed and the ankylosis discovered.

Dr. KETCH said there was one point he would like to call attention to, and that was the question of ankylosis, or the amount of motion that we will have when we are through with our treatment of the joint disease. He alluded more especially to hip-joint disease. It is the habit of some surgeons to make promises to their patients regarding the amount of motion they will have after the joint is completely cured. He would hold that no surgeon at the outset of the case, no matter how slight the symptoms, was able to prognosticate the amount of motion the patient would have in his joint. He had seen cases where the symptoms apparently in the beginning were slight, and where the general health was not bad, but where a condition had supervened, designated by Germans as caries sicca. These cases were not unfamiliar to those who have had extensive experience in the treatment of hip-joint disease. In these cases the course of the disease was chronic, and the results not so good as in the acuter cases.

Another very important point was, Can we, by immobilization of joints, give our patients that amount of relief from pain and suffering that we do by traction? His experience had taught him that we cannot. He had on several occasions immobilized patients with joint disease, and was unable to give that amount of relief to pain and suffering which he thought could have been accomplished had traction been resorted to. He would hold that poor traction was worse than no traction at all. Immobilization without traction does not give the relief that we get from the use of traction.

Dr. Steele. — We are told that an extension equal to three or four pounds' weight is quite sufficient; but I would in all fairness ask if such a power would separate the articulating surface, or so far relieve the pressure that these surfaces could be moved without friction. *So long as there is contact, there must necessarily be friction on motion.*

In my early orthopedic studies I imbibed the American ideas and adopted its practice, but my results were other than satisfactory. Some cases died; with others abscesses continued for months; others were sadly deformed, and with ankylosis. A re-investigation and study of the whole subject, with extended observations at home and abroad, forced the conclusion that when inflammation existed in any tissue or organ, then the therapeutic indication was rest. Affected joints were no exception to the rule, and should not be made such. The advocates of splints with movable joints claim that in avoiding friction they avoid causative increase in the inflammation. But it is not the rubbing together of the cartilages that alone does harm; it is the motion, movement, action of all the articular and periarticular structures. No portable appliance yet devised will so far separate the joint cartilages as to prevent contact; and where there is contact, there must necessarily be friction if there is motion.

The other argument, that "if motion is allowed in the joint, there is less danger of ankylosis," is fallacious; for to prevent joint stiffness, the joint inflammation must be arrested. The sooner the latter is achieved, the less the danger of the former.

The cry for fresh air and sunlight is all right; but these, Nature's remedies, can be given the patient by the employment of other means than by the movable-joint-portable splint. In the earlier and active stage of hip disease, I place the patient on a "stretcher splint," which more thoroughly immobilizes the joint than Mr. Marsh's recumbency-and-weight extension, or Mr. Thomas's posterior bar appliance, and besides allowing transportation from room to room, place to place, out into the fresh air and conveyance by carriage, motion is allowed to the head and neck, both upper extremities and one lower; there is no disturbance of the body for defecation, so the joint is kept perfectly still for weeks. I have so confined patients for months and months, and always with improvement; have never had a bed-sore; patients increase in flesh, and are happy and contented. The objection that the increase of weight is the "flesh of inertia" is sophistical. With a grave

disease like morbus coxarius present, cases do not fatten very greatly if the disease is progressing. Absence of pain and increase in weight are good proof of arrest of the disease. It is due our Boston friends to say that I received from them, some years since, the idea of a stretcher, or bed and splint combined. I had expected to have heard ere this, and may yet, from the gentleman who claims "motion without friction," the argument that hip disease, in the early stage at least, is a deep bone trouble without as yet involvement of the joint, and that therefore articular motion can do no harm. Now, there is a grain of truth in this; but motion induces increased flow of blood to all the contiguous parts, and the more blood, the more rapid the inflammatory action may become. No; perfect rest to inflamed joints is rational therapeutics, and later, when all inflammation is arrested, then, and not till then, motion.

The results, as published in another place by our President, of the treatment of hip disease with the Taylor splint are certainly most excellent. That my experience was less favorable may possibly be attributable to want of skill in applying and managing the instrument, — such at least as is possessed by some of our members, as Shaffer, Sayre, Judson, Lee, and others. We do not recall advocacy by these gentlemen of movable joint splints for disease of other articulations than the hip. If so efficacious in the latter, why not in the others? Consistency is a jewel. Yes, there was one exception to the above statement: Taylor's antero-posterior spinal brace contained a joint or joints in the vertical upright, which was to allow posterior motion, — a bending backwards to allow, yes, to favor posterior bending by the patient as a therapeutic indication; such was the claim. But experience has modified the reasoning so that now the partisans of this splint claim that the hinge is only to facilitate adaptation in application, to better its fit.

Dr. A. B. Judson, of New York. — I deplore as much as any one the fact that there is so much difference of opinion in regard to the treatment of chronic joint diseases, and wish something might be done to remove these differences and establish greater uniformity in practice.

The idea seems to be less prevalent than it was that a perfect cure is to be expected with confidence. It is necessary, however, to strive for such a cure with normal mobility and measurements; and it seems to me that this may best be sought by immobilizing or fixing the affected joint, and if the affection is in the lower extremity

by preventing the patient from standing and walking with the affected limb touching the ground. When these points are attended to and the patient's hygiene is properly managed, it seems to me little more is to be done beyond expectation.

In regard to operations in these cases, my experience has given me such a high estimate of the power of Nature to repair a disorganized joint that I would dissuade from a resort to operative treatment in almost every case.

To enter a little more into details, I would say briefly that in my opinion the ankle joint in many cases may be left without any artificial method of fixation, that the knee may be well fixed by a simple retentive splint, acting somewhat as a lever; while the mechanical difficulties, which from the nature of the case beset the task of immobilization in the hip joint, make it desirable to resort to the fractional degree of fixation which is secured by traction. In the mechanical treatment of either of the joints mentioned, I would resort to a portable splint which receives the ischium on a crutch-head or perineal strap while the well side is elevated by a high shoe.

At first sight it would appear that the ankle, as well as the other joints mentioned above, required fixation, but on further consideration it appears that the foot is so much smaller and lighter than the rest of the body that its motions may be easily arrested by the action of the muscles which control the ankle joint. But when the knee is affected and it becomes desirable to prevent motion of the joint between the leg and the rest of the body, the foot and leg are so considerable in size and weight that the muscles which control the knee joint are incompetent to secure unaided the fixation of this joint. And when we come to the hip joint one glance at a patient in the acute stages of hip disease grasping the thigh with both hands the livelong night to steady the painful hip joint is sufficient to convince one of the necessity of artificial fixation. The knee may be fixed by taking advantage of the leverage afforded by the long bones above and below the joint. But the hip joint has on one side of the line of motion a long bone, the femur, and on the other side the os innominatum, which is almost useless as a lever. We therefore apply traction; and here comes in what I consider the most important function of traction, namely, the production of a fractional degree of immobilization, not so absolute as is desirable, but enough to act as an anodyne and promote resolution of inflammation and repair of the tissues. I have always avoided the use of

the word "immobilization" in this connection, because it means too much, and have thought that the word "fixation," not having been very definitely appropriated, might come to be considered as expressing the peculiar degree and character of what is produced by traction.

In regard to the question of ankylosis, I fully concur with those who have expressed the opinion that the best way to avoid or lessen this sequel of joint disease is to fix or immobilize the affected joint as completely as possible. So far as the joint is healthy, immobilization or fixation is powerless to produce a serious impairment of motion; and so far as the joint is diseased it will prevent or lessen the degree of ultimate ankylosis by giving the joint the benefit of the best of all antiphlogistics, arrest of function. Mr. Thomas, of Liverpool, seems to have been the first to emphasize this view of ankylosis in its relation to joint disease.

Dr. Moore. — I suppose the proper ground is half-way between. I have been adopting that principle in my treatment. In some cases I apply a fixation apparatus without extension; at other times I apply an extension apparatus. I confine the application of the fixation apparatus to the very severe cases that come to me in which there is a destructive condition of the joint. At an early period of joint disease, I should not think of fixing the joint absolutely. I do not believe that fixation causes ankylosis, because I have time and again reduced the amount of ankylosis by fixation. That demonstrates to me that the ankylosis was due to inflammation, and that when we get ankylosis of the joint after treatment from fixation, it is due to the inflammation. I think if we were to make a section of the joint we would find that the pathological condition could not have been brought about save by the disease that was present. Some of the gentlemen here have questioned the possibility of relieving pain by fixation without traction. I believe firmly in traction; I could not get along without it satisfactorily. I can, however, in many of the severe cases relieve pain absolutely by fixation without traction.

It therefore seems to me that the ground we wish to stand upon is half-way between. I have many times changed from one appliance to another. We will say that Thomas's splint is the representative of one idea and Sayre's splint is representative of the other. I have many times exchanged these splints each for the other, owing to the particular indications at particular times.

Dr. Phelps. — I believe that the question in point is whether we shall perfectly immobilize the joints in cases of inflammation or move them from time to time.

I fully agree with Dr. Gibney that the more perfectly a joint is immobilized the better our results will be, but that immobilization *cannot be accomplished without extension.*

Dr. Sayre and others have taught and still teach that the joint should be fixed and extended during the period of acute or active inflammation; then after that period has passed passive motion should be instituted.

This has been called the American plan. Dr. Thomas, of Liverpool, teaches that absolute fixation or immobilization of an inflamed joint should be performed from the outset to the termination of the inflammation, — that ankylosis will not be induced by fixation; that when ankylosis does follow, it is not from the immobilization, but due to the disease itself. These, I believe, are the points under discussion.

I do not believe that a normal joint can become ankylosed from any amount of immobilization. I have for some years treated joints by absolute immobilization. I have fixed a hip joint for hip-joint disease in a wire cuirass for eight months, the case recovering without abscess and with normal motion. This case, together with many others of other joints, leads me to believe that ankylosis is due to the severity of the inflammation involving particular parts. I believe, however, that so soon as all inflammatory action has subsided, passive motion, massage, etc., should be instituted for the purpose of increasing the circulation through the joint, thus aiding Nature in her efforts at absorption.

Finally, I think that any fixation splint not combining the principle of extension did not accomplish the end desired, namely, absolute immobilization; but a combination of fixation with extension did.

Dr. Lewis Hall Sayre. — I fully believe in the efficacy of traction in all the joint diseases under discussion; and until I see very much better results from immobilization, I shall be inclined to keep on with the plan I have been pursuing.

Dr. Ketch. — Dr. Moore is under the impression that I stated immobilization did not relieve pain. I did not make such a statement. I said I was unable to relieve pain as promptly by immobilization as by means of traction.

Dr. Gibney, who was compelled to leave before the discussion, by

vote of the Association was permitted to close the discussion in writing. His remarks are as follows: —

The case reported so fully by Dr. Sayre is familiar to many of us as one that is referred to in the chapter on "Ankylosis" in "Orthopedic Surgery and Diseases of the Joints." We are told now that Dr. Bauer saw the case and put it in the wire cuirass. Dr. Sayre, who did not see the case at this time, tells us that there was "perfect motion in every joint." We are told also that the boy remained "immobilized perfectly" in this cuirass for eleven months, because the local physician did not dare change the dressings. Now, Mr. President, must we believe that "perfect immobilization" can be secured by roller bandages (not renewed) for a period of eleven months in the case of a *live boy?*

We are not told who removed the cuirass at the end of this period, nor are we told who recorded the observations as to "perfect consolidation" of all the joints. Yet we are told that "he had never complained of any pain in any of his joints during all those eleven months, neither had he any fever." We are not told Dr. Sayre's authority for this statement, and hence I for one do not accept his premises as facts, when he admits himself that neither Dr. Bauer nor himself saw the boy during this whole period.

The syllogism, therefore, which Dr. Sayre enunciates with so much emphasis by all rules of logic is faulty.

I disclaim, Mr. President, any discourtesy to my distinguished friend when I protest against his employing this Kentucky case, so traditional in all its features, as an argument against immobilization in articular disease.

Understand me to say that I am quite willing to accept Dr. Sayre's own observation made "some years afterwards" as to the condition he found.

Dr. Lee, while not adducing any cases to show that immobilization produces ankylosis, expresses his belief that the danger is "a real one." In arraigning me for "special pleading," he denies the statement made by Dr. Sayre, that ankylosis can take place "without inflammation;" for he says, "Certainly any inflammation or injury sufficiently severe to induce ankylosis ought to attract the attention of a surgeon of ordinary powers of observation."

ETIOLOGY AND PATHOLOGY OF RHACHITIC DEFORMITY.

With a Report of one hundred and fifty-eight Consecutive Osteotomies without Suppuration.

BY CHARLES N. DIXON JONES, B.S., M.D.,

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ANY one who has read Sir Walter Scott's touching and sympathetic story of the "Black Dwarf" can appreciate the intense mental suffering which a person of a sensitive and highly organized mental constitution experiences on account of marked bodily deformity. This ideal being, who was represented as residing in solitude, haunted by a consciousness of his own deformity and a suspicion of his being generally subjected to the scorn of his fellowmen, was not altogether imaginary. As he says of himself, "I am a poor miserable outcast, fitter to have been smothered in the cradle than to have been brought up to scare the world in which I crawl." The sense of his deformity haunted him like a phantom, until at last he became alternately a pilgrim and a hermit, suffering the most severe privations, not indeed in ascetic devotions, but in abhorrence of mankind. Such a character could only have been suggested by a close and intimate acquaintance with rhachitic deformity.

Rhachitis is a disease of early life. All who are connected with our large dispensaries must have observed the great prevalence of this disease among the applicants for medical aid. While more common among the children of the poorer classes, still it is not infrequently met with among the children of the better classes of society; perhaps not in its most advanced stages, yet it is sufficiently well marked in some of its manifestations to be easily recognized. While not so common in this country as in some of the European countries, yet according to Dr. Parry, in the Philadelphia Hospital, twenty-five per cent of

all the children between two months and four years of age are rickety; while in some of the European countries, especially in England, Scotland, and parts of Germany, the proportion is even greater. The recent report of the Collective Investigation Committee of the British Medical Association states that rickets, though not unknown in rural districts, is mainly a disease of towns and industrial regions, and especially of large industrial towns. In the densely populated and industrial portions of England and Scotland it is especially prevalent, and is all but universal in Glasgow and its suburbs.

In the New York Infant Asylum, a few years since, one in every nine, by actual count, presented marked rhachitic symptoms. In this country the disease occurs for the most part in children whose parents were born in Europe, principally the Anglo-Saxon and Latin races. It is comparatively rare in children of native Americans, with the possible exception of the negro race, among whom it prevails to a most astonishing extent.

Rhachitis, or rickets, is a disease that should command not only the attention of the surgeon, but that of the general practitioner as well, in order that its results, deformities of the limbs and abnormal shapes of the chest and pelvis, may be prevented.

Rhachitis has been defined, by Bouvier, as an affection of the young, a vice of ossification, with softening, curvature, and deformities of the bones. This definition is clear and precise, and is founded on a lesion and a condition which are anatomically well characterized, but it does not fully cover the ground. Rhachitis is a general constitutional defect, and the osseous structure is involved in common with every other tissue of the body.

It should be remembered that rhachitis is not a disease of the bones alone, but according to the most recent writers is a general nutritive disorder, which affects all structures, not only bone, but muscles, ligaments, skin, mucous membrane, the blood, arteries, and the nervous system. "It is complicated with or dependent on disorders of the digestive or respiratory apparatus, which are preceded by a disposition probably created by an undue width of the arteries." (Jacobi.)

One of its prominent symptoms is muscular debility, sometimes so great as to be mistaken for actual paralysis. The patient may appear plump and fat, but his muscles are flabby. Changes in the subcutaneous tissue are also present; fat is either present in excessive amount, or deficient. Changes in the mental and moral faculties are also present. Enlargement of the spleen, liver, and of the lymphatic glands in different portions of the body are common accompaniments of this disease.

Rhachitis affects the growth of the teeth. The appearance of the teeth is retarded, or if they make their appearance they soon drop out. Sir William Jenner states that if the child have no teeth by the ninth month, it is probably rhachitic. Usually only one set appears, and these are wide apart and few. This fact will be further illustrated in the cases to be presented. See Plate IX.

While the above-mentioned symptoms are manifesting themselves, most important changes are taking place in the bones. These consist in an hyperæmic condition of the primordial cartilages of the epiphysis, with copious deposits of new material in this region and also under the periosteum, with softening of the diaphyses so that curvatures occur; and while this process continues true ossification of the bone does not take place.

Historical. — There is good reason to believe that this disease was described by Hippocrates and Galen. Bootius and Severin, who claim that there can be no complete medical history without the mention of these names, have found among the writings of these authors descriptions of diseases analogous to rhachitis. Others believe that there has always existed a species of rhachitis, even although this affection was never scientifically described. Literature has preserved, even to our times, types of deformity such as that of Æsop and Thersite, who lived centuries ago and presented types of rhachitic deformity.

The first scientific description of the symptoms and pathology of this affection was written by Whistler, and appeared in England in the early part of the seventeenth century. While to England belongs the honor of first describing this disease, it has also the not so enviable distinction of having the disease denoted by its adjective appellation; for rhachitis still goes by the name

of the "English disease," — in French, Morbus Anglicus; German, Englische Krankheit. Glisson, about the year 1650, gave a description of this disease, and used the term "rhachitis."

Etiology. — In studying the etiology of rhachitis, we must approach it from two points of view, its predisposing and its direct causes. The predisposing causes of rhachitis have been studied by Beneke from an anatomical standpoint. He found that the arteries in rhachitical patients were abnormally large. In three cases where the arteries of the neck were unusually large, the children died young, — one of hydrocephalus, one of an abnormally large skull, and one suddenly. The period of life at which the arteries are found to be abnormal corresponds to the time at which the rhachitic process is most marked; namely, the second to the fourth year of age. This affords an explanation of the hyperæmic condition of the bones, especially at the junction of the epiphysis, where the growth of the bone is most active, and also of the increase of development and eburnation of the bones after the morbid process ceases.

As above stated, in rhachitis, the normal proportion of the blood vessels to the heart is greatly changed. Of this Jacobi [1] well says: "As it is not probable that a chronic disorder in its slow progress should work a rapid change in the blood vessels, the inference is a sound one, that, if the disorder cannot have altered the blood vessels, these must have given rise to, or be connected with, the nature of the disorder. For instance, in rhachitis the heart is of average size, but the arteries are abnormally large. Great width of arteries lowers blood pressure. Thus is best explained the murmur (first discovered by Fisher, of Boston) over the fontanelles of rhachitical babies; very much better than, as Jurasz asserts, by osseous anomalies in the carotid canal. Another result of the low blood pressure is the retardation of the circulation in the muscles, with flabbiness and incompetency as consequences; and still more about the epiphyses which swell and soften. It is very much less the cartilaginous condition of the epiphyses which give rise to rhachitis (for some of them do not ossify before the twentieth year or later, at a time when no rhachitis is observed) than some constitutional

[1] Address, February, 1887.

disorder of which the principal one may be, as stated, the unusual size of the blood vessels. There are other anomalies in rhachitis which aid in the retardation of circulation; namely, the large size of the liver and the smallness of the lungs. Through these influences ossification becomes irregular and defective. The slowness and irregularity of the circulation, dependent on these conditions, together with the watery condition of the blood, are the predisposing causes giving rise to catarrh of the pharynx, larynx, and respiratory organs in general, with which rhachitical subjects are so generally affected.

There is another interesting consideration to which one writer has drawn attention: owing to the relatively large diameter of the arteries, a greater number of red blood corpuscles is required, in order to properly fill them. Now, in the rhachitic, owing to the impairment of the digestive and hæmatopoitic organs, the blood-making process is not so active; so the tissues must necessarily show the effect of the relative increase of the watery constituents of the blood, — a condition which the biochemists have found to uniformly exist in the rhachitic.

In the healthy infant the pulmonary artery is larger than the aorta, by not more than four millimetres. In the rhachitic subjects examined by Beneke, the pulmonary artery was found to be proportionately much greater in size, thus affording an anatomical explanation of the pathological processes so frequently found in the lungs of the rhachitic. For while the amount of blood carried to the lungs is relatively greater than in the normal condition, owing to the disease of the bones of the chest, the lung space is contracted, and consequently the circulation of blood in the lungs is impeded.

There is also a variation of size in the other organs of the rhachitic, and the combination of variability found in the rhachitic subject does not correspond with that found in other constitutional disorders; as for instance in scrofula, where Beneke found a small heart, unusually narrow arteries, and a small liver. From these considerations the conclusion is drawn that these variations of size are not the result of the disease, but that they are congenital and stand in some causal relation to it.

The direct cause of rhachitis was attributed by Glisson to

the inequality of nutrition by the arterial blood, and the curvature of the long bones to their superabundant vascularization. John Mayow (1761) held a disturbance of the innervation responsible; Zeviani (in the same year), improper food in general, and particularly prolonged lactation; others have attributed it to an undue production of acid and the softening of the osseous tissue thereby. C. Heitzman fed both herbivorous and carnivorous animals with lactic acid, and found the cortical layers of the bones softened, and the medullary substance hyperæmic, and claimed to produce osteo-malacia in the former, and rhachitis in the latter.

It cannot be doubted that rhachitis occasionally occurs as a congenital disease. Cases have been reported by Chiari, Jacobi, Burrall, and Gueniot. Kassowitz examined many still-born infants, and also children dying shortly after birth, and in a large majority found rhachitical changes in the ends of the bones. In many of those who lived several weeks after birth the rhachitical changes were advanced to such a degree that its uterine origin became clearly demonstrated. I have observed well-marked bowing of the tibiæ at birth.

Dr. W. B. Cheadle (Brit. Med. Jour.) says: "That direct inheritance is not a constant or essential factor is proved by the fact that perfectly healthy parents, who have never been rickety and show no trace of it, may have and constantly do have rickety children. We may then eliminate inherited tendency, at all events, as an essential condition."

Schwartz (Med. Jahr. 1887) has demonstrated, by an examination of 500 children within an hour after birth at the lying-in hospital in Vienna, that the signs of rhachitis can usually be found at that early period, showing the disease to be, at least usually, intra-uterine in its commencement. Of the 500 children, 97 were without signs of this disease, 188 had well-marked rhachitic rosaries, together with rhachitic changes of the cranial bones, varying from an abnormal weakness along the borders of the sagittal suture to an almost complete defect of ossification of the cranium, 155 had well-marked rhachitic rosaries without the changes in the cranial bones, 36 had the changes in the cranial bones alone, and 24 presented only slight

swellings at the union of the bones and cartilages of the ribs. Of the children born in the seventh lunar month, 14 were rhachitic, 1 normal; in the eighth lunar month, 27 rhachitic, 4 normal; in the ninth lunar month, 50 rhachitic, 12 normal. Fifteen of the mothers of rhachitic children presented signs of having suffered from a high grade of rhachitis. Of six cases of twins, in three one child was normal, while the other was rhachitic. In the others both children were rhachitic. His conclusion is that every child should be examined as soon after birth as practicable; and if any signs of rhachitis are found to be present, active treatment should be immediately instituted (N. Y. Med. Jour., vol. xlvii. p. 13).

Rhachitis is a disease occurring during the rapid development of the tissues; therefore anything that interferes with normal growth and development is apt to change physiological function into a pathological condition and produce rhachitis. Therefore all influences that impair the nutrition and reduce the strength in parent or the child itself, such as bad feeding, foul air, damp cold rooms, want of sunlight, want of exercise, and want of cleanliness, must be looked upon as predisposing causes of this disease.

Of the many special causes that have been brought forward at one time or another as the essential agent in the production of rhachitis, that of special defects in diet, or a faulty composition of the child's food, has perhaps the strongest claim on our attention.

In a Discussion on Rickets at the Annual Meeting of the British Medical Association, August, 1888, Dr. W. B. Cheadle, in introducing the subject, claimed that "the food factor is the only factor which is anything like constant." He believed it traceable in every instance. Syphilis may be absent, hereditary taint may be absent, all external conditions of mal-hygiene may be absent; yet, in spite of this, a child brought up on artificial food may become rickety. The fault lies in some defect in the artificial food, in some quality in which it differs from the non-rhachitic food of human milk. The form of improper feeding most frequently associated with a rickety condition is a farinaceous diet.

An examination of the different artificial foods shows a grave defect which is common to all, — they are remarkably deficient in two important elements; namely, animal fat and animal proteid. The abundance of fat in human milk, constituting as it does one fourth of the whole solids, indicates its extreme importance as a constituent in the food of the growing child.

An inquiry into the diet of the rhachitic children that have come under my observation supports the views of Dr. Cheadle. Many of them have been fed on diluted condensed milk, or other foods in which animal fat and easily digested proteids were conspicuously absent. Several of the children while under treatment have shown an aversion to butter and milk; and inquiry has elicited the fact that these articles of food have formed a very small proportion of their former diet. In support of his views Dr. Cheadle cites the experiments in the feeding of the young animals in the Zoölogical Gardens, London. A single example will illustrate. It seems that the young animals are extremely liable to become rhachitic there. In rearing the young lions, as a rule, the lioness cannot be trusted to suckle her cubs; she either injures them or neglects them, and they have to be fed by hand. The food on which they have hitherto been fed, the flesh of old horses, is almost destitute of fat. The bones were found to be proof against the teeth of the adult lions even, and those of the cubs were powerless to deal with them. Once a week they were given goat's flesh, which is also poorly supplied with fat. This diet would be especially deficient in fat and the earthy phosphates. The feeding of the last litter of lion cubs was commenced in the same way. They quickly developed marked rickets, and one died. Then, at the suggestion of Mr. Bland Sutton, the diet was changed. The meat was continued, but in addition to it cod liver oil and pounded bones were given with milk. No other alteration whatever was made in any way. In three months all signs of rickets had disappeared; and now at eighteen months old, they are perfectly strong and healthy and well developed, — a unique event in the history of the Society.

He sums up the general pathology of ordinary rickets thus: —

1. It is primarily a diet disease, which can be caused at will

by a rhachitic diet just as certainly as scurvy by a scorbutic diet, and which can be cured as certainly by an anti-rhachitic diet as scurvy by an anti-scorbutic diet.

2. That the chief defect in diet which causes rickets is want of animal fat.

3. With this probably also deficiency of the earthy salts in form of phosphates.

4. A deficiency of animal proteid in conjunction with the preceding intensifies the condition.

5. The rickety state is accentuated by evil hygienic conditions, such as foul air and want of light, although these are not essential to its production.

6. Rickets is modified in character by the concurrent existence of congenital syphilis and of scurvy.

Chemistry. — Defective calcification of the forming bone is one of the leading features of rhachitis. The normal proportion of lime does not enter and cannot remain in the osseous tissue, but is rapidly eliminated by the kidneys and intestinal tract.

One hundred parts of bone, according to the analysis of Gorup Besanex, contain

	Ossein.	Phosphoric Acid.	Lime.
Healthy bone	34	26	34
Rhachitic femur	72	7	9
" tibia	60	12.9	17

Thus chemical analysis confirms the experiments of the pathologists.

Pathological Histology. — Rhachitis is a disease of the osseous tissue, occurring during the period of development of bone. It is characterized histologically by disturbances of nutrition of the tissues that contribute to the development of the bone. We must then look for the disturbance of a physiological process at the points where the growth of bone occurs; namely, the periosteum and the places of opposition between epiphysis and diaphysis.

Normal Ossification. — The long bones are developed from cartilage. The skeleton of the embryo is first formed in cartilage, and normal ossification occurs with great regularity. This precursory cartilage may be regarded as a temporary sub-

stitute for bone, affording, as it were, a mould of definite figure and form in which the osseous material may be subsequently

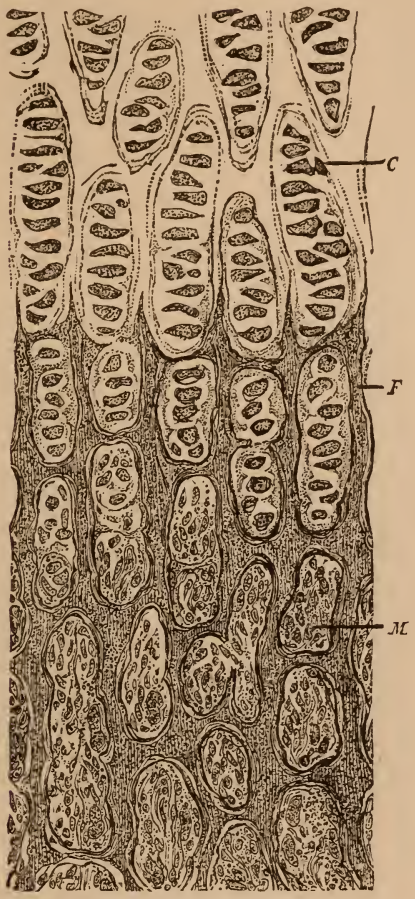

FIG. 75.

Humerus of Embryo, five months old. Sagittal section. (Heitzmann.)

C, rows of cartilage corpuscles in elongated groups, due to their territories. *F*, frame of calcified basis substance, around which, in the lower portion, the first traces of bone tissue are noticeable. *M*, medullary space, containing medullary corpuscles, magnified 500 diameters.

deposited. A section of the bone shaft of a human embryo at about the fifth month shows that it is composed of hyaline cartilage with many medullary spaces. At the point where

calcification first commences, the cartilage cells become arranged in regular rows. At this point the basis substance is soon found to be the seat of calcareous deposition. This is beautifully shown in the accompanying drawing taken from a specimen in my possession (Fig. 75). If we examine minutely a section of an ossifying bone, it may be observed that the cartilage cells at a distance from the ossified part are uniformly disseminated in the matrix, but at or near the point of ossification the cells are arranged in rows, or oblong groups, between which the transparent matrix appears in the form of clear, longitudinal lines, obliquely intersecting each other at intervals. At a point lower down it may be observed that this clear matrix, together with portions of the capsules of the cartilage cells, have become the seat of an earthy deposit, so that the new calcareous material at first forms oblong areolæ or loculi, enclosing the groups of cartilage cells. But this process of calcification which differs from that of true bone formation is only transitory; and a short distance below we see a change taking place in the newly formed tissue. The primary areolæ above described open into one another both laterally and longitudinally, and by their coalescence give rise to large secondary or medullary spaces. The primary calcareous plates are all finally absorbed, while the walls of the medullary spaces are thickened by the deposit of layers of new bone. In the mean time the cartilage cells have disappeared, and the bony cavities become filled with soft material and numerous coarse granular corpuscles or osteoblasts. Some of these cells begin the formation of bone tissue, while others are surrounded by the osseous substance and become bone corpuscles. The formation of blood vessels is taking place at the same time; a portion of the cartilage corpuscle becomes transformed into a club-shaped vesicle containing red blood corpuscles; several of these unite, giving rise to capillaries, which subsequently connect with the older blood vessels, and their contents become parts of the general circulation. The calcareous deposition occurs only in the broad masses of basis substance, between the regions of the cartilage corpuscles; and lower down, the spaces are filled with medullary corpuscles. At the lower portion the first traces of new bone can be seen,

in the form of bright rings attached by their convex surfaces to the calcified frames. This framework of calcified tissue is soon dissolved, and the cartilage cells proliferate, forming medullary cells. True ossification now begins.

Ossification in Rickets. — We have seen that in the normal process of ossification the cartilage is reduced to an embryonic condition, giving rise to medullary cells. At the same time the formation of new blood vessels occurs. In rickets all this pre-

FIG. 76.

Rib of a Rhachitic Child in transverse section, magnified 200 diameters. (Heitzmann.)

C, cartilage corpuscles arranged in territories. *MS*, medullary space sprung from cartilage tissue. *M*, medullary tissue with very large blood vessels. *BV*, *B*, a scanty new formation of bone tissue.

paratory process is going on at a more rapid rate, but the formation of new bone from the medullary tissue is very scanty or entirely absent.

In a sagittal section of the epiphyseal end of a rhachitic bone we notice a zone of an intensely reddish color at the point of transformation of cartilage into medullary tissue. The cartilage

cells contain a larger amount of bioplasm than normal; the calcification of the cartilage is scanty or absent, and occurs in irregular patches. An increased formation of blood vessels occurs. At the peripheral portions of the epiphyseal cartilage a formation of vascularized cartilage, instead of bone, can be traced; while the newly formed trabeculæ of bone are scanty, irregular in shape, and filled with large bone corpuscles. This is well shown in Fig. 76, drawn from a specimen.

At the borders of the bone shaft we find between the thin cortical bone tissue and the fibrous portion of the periosteum a broad layer of medullary tissue. The vascularization of this tissue is so great as to give rise to the appearance of a hemorrhage. The bone generally remains in a stage of cancellous structure with large irregular spaces. As Kassowitz well says, lime cannot be deposited in the immediate neighborhood of a copious blood supply. But why does the rhachitic process have a special affinity for the growing bone? Kassowitz urges that the growth of bone differs from all other tissues, in that the latter grow uniformly throughout their whole mass, that the circulation in them is more uniform and carries nutrition into and through every particle simultaneously, while in the bones the only places in which the whole circulation can contribute to their growth are the epiphyseal cartilage, periosteum, and marrow. Every morbid irritation, whether resulting from bad air, food, and habitation, or from acute or chronic ailment, acts on the whole mass of other tissues and organs, but in the bones only on the growing ends or surfaces. During the active progress of this disease the bones can be bent by the least possible force, and their spongy portions can be easily cut with a knife.

The ligaments are often altered in their structure and become relaxed. This is shown in the yielding spine and the relaxed knee and ankle joints. If the bone deformities remain uncorrected, this relaxation exists even until late in life. In one case which has come under the author's observation, a condition of bow legs still existing in a man fifty years of age is associated with marked relaxation of the crucial and lateral ligament, apparently due, in part, to an effort of the patient to overcome the

genu varum by a still further stretching of the internal lateral ligament.

However profound may have been the pathological changes in the bones, as soon as the tissues become properly nourished and the child commences to recover from the disease, the bone cells rapidly take up calcareous matter from the blood, and dense bone is formed, producing the condition called eburnation or sclerosis. Rhachitic changes in the osseous tissue do not affect all the bones of the skeleton in equal degree, or even the different portions of any individual bone to the same extent. The bone of one limb may be quite hard while the other is soft, or the softening may be more marked in the shaft than in the epiphysis, or vice versa. In operating, I have often noticed that the bone of one limb was softer than that of the other. Macewen claims that different deformities may be explained by this irregularity in the portion of the bone on which the intensity of the rhachitic process falls.

Rhachitis is not usually developed after the age of five years, although Macewen believes that it may be developed even up to the twentieth year of age, especially after the exanthemata or other debilitating disease. I have not met with cases of this character.

Reindfleisch thus describes the manner in which the deformities occur: "The bones bend, or what is just as common, they break on one side like a roll of paper, while the other side is simply stretched across the seat of fracture, and the central marrow is crushed." (Green stick fracture.)

Rickets being assumed as the general and common predisposing cause of these deformities, what is the element or the direct and determining cause of the deformity?

The theory that the deformities are the result of muscular action cannot be supported by facts. As pointed out by Ogston, the normal shape of the bones is produced not so much by forces within themselves as by the action on them of normally acting muscles and such-like external agents. It should be remarked that the inferior extremities are more curved than the superior,—a fact which did not escape the observation of Glisson. This fact can only be explained by their position and that they support the weight of the body. It has been observed that children

who are confined to bed during the acute stage of rickets, and in whom the weight of the body is prevented from being thrown on the lower limbs until the bones are firm, are not the subjects of these curves. Again, those persons whose occupation compels them to stand much of their time on their feet are frequent subjects of such deformities, so much so that the German vernacular for knock-knee is "backerbein" (baker's legs).

The causes determining the special deformity in any given case are various, — the intensity of the rhachitic process in any particular portion of the bone affected, and the age of the person affected. The more intense the action and the younger the person, the greater will be the number of curves. The tibial curves belong to the first two or three years of life.

If the shafts of the bones are more affected than their extremities, one would expect bow legs and not knock-knees; if on the other hand the distal extremities of the femur are more affected and the shafts less, one would expect genu valgum as a result. The particular manner in which the weight of the body is directed on the bones, — whether the child walks, creeps, sits, or shuffles along the floor, — each has its effect.

Attention has not been drawn to the fact that in crawling along the floor the weight of the body is thrown on the knees and inner sides of the malleoli, thus tending to produce genu valgum. It should also be remembered that the deformities are frequently but exaggerations of normal curves.

Professor Fisher has drawn attention to the fact that all organs during their growth assume a spiral shape something like a corkscrew, and that the spiral curve always takes a definite direction right or left, according to their anatomical relation to a central axis. Many deformities he attributes directly to an increase or diminution of normal spiral curves, as, for instance, scoliosis and genu valgum and varum.

Surgical Treatment of Rhachitic Deformities. — While it is true that every case of knock knees or bow legs does not demand surgical interference, yet the spontaneous cures with rectification of the deformities are exceedingly few. While the bones are soft, orthopedic apparatus may be of benefit; but after eburnation has taken place or even well advanced, they are

worthless. The importance of the early recognition and the early treatment of bow-leg and knock-knee deformities cannot be too strongly emphasized. Although there may be a slight improvement in the deformity, corresponding with a general improvement in the health and nutrition of the individual, yet the expectation of a perfect cure by unaided Nature will most frequently end in disappointment. Far better results, in a shorter space of time, with much less suffering, can be obtained by judicious surgical interference. I fully agree with Roberts that "the surgeon who assumes the responsibility of giving advice or administering treatment in these cases should never be content short of a result which will enable the patient to advantageously receive the weight upon his legs when in the erect posture." The prime function of bone is to sustain weight. If the relationships of the long bones of the lower extremities are not such as will permit of their receiving advantageously the entire weight of the body, an undue strain on the soft parts is inevitable, and sooner or later discomfort or suffering will, as a rule, result. The pain and discomfort which result from the continuance in adolescent and adult life of even a slight amount of deformity is often very great; especially is this the case, if with increased years there is a proportionately greater increase of weight of body. A reason for this belief is the frequency of adult cases of deformity seen on our streets; I have frequently counted as many as ten or fifteen in a few hours' walk. In Glasgow, notwithstanding the enormous work of Macewen and other surgeons, an equal number of cases may be counted in a walk of a few minutes, showing conclusively that many cases never become corrected spontaneously.

"Osteotomy," says Macewen, "in its broadest acceptation may be defined as a section of a bone. It has, however, been regarded in a much more restricted sense, the term being applied to such divisions of bone as have been proposed and undertaken for the relief of deformity, for the rectification of badly united fractures, and for the straightening of limbs affected with osseous ankylosis, which are fixed in a bad position." ("Osteotomy.")

The first osteotomy for the rectification of ankylosis was performed by Dr. John Rhea Barton in 1826. Langenbeck, in 1852,

made a division of the femur for ankylosis of the hip joint by perforating the bone with a drill through a small wound in the soft parts, and then divided the bone with a narrow saw. To this operation he gave the name of subcutaneous osteotomy.

In 1875 Volkmann, of Halle, operated antiseptically on two cases of ankylosis of the knee joint, and in the same year Macewen performed a similar operation.

These two influences, the introduction of Listerism and the subcutaneous method of Langenbeck, have made osteotomy one of the safest operations in surgery. Without the advent of antisepticism osteotomy would have remained an operation confined to the few, or would have entirely receded from the field of surgery. The honor of introducing antiseptics into osteotomy is due to the distinguished Volkmann, of Halle.

Various instruments have been employed for the performance of osteotomy, including trephines, bone perforators, gimlets, chain saws, round saws, ordinary saws, trocar saws, and electro-saws, some for subcutaneous and others for open wounds; the last and best of all is the chisel. There are two forms of instruments of the chisel order: in one the blade is formed as in the ordinary carpenter's chisel; in the other the blade has the shape of an attenuated inclined plane, and to this Macewen has given the name "Osteotome" in order to distinguish it from the chisel proper (Fig. 77). The osteoclast is an instrument of tremendous and brutal power, which I hope will never be generally adopted by American surgeons. As some one well puts it, the osteoclast should become an historical surgical reminiscence, while Macewen's chisel should be canonized as the ideal scientific corrector of bone deformities.

Osteotomy may be either linear or cuneiform. A section of bone by linear osteotomy is made through a small wound in the soft parts, just large enough to admit the osteotome. In performing cuneiform osteotomy a large open wound must be made, and the operation is therefore not subcutaneous.

In performing either subcutaneous or cuneiform osteotomy, strict antiseptic precaution should be observed; by this means we secure perfect immunity from inflammatory complication, and a compound fracture heals as a simple fracture.

The patient should be profoundly narcotized before commencing the operation, as any movement of the limb produced by muscular contraction might disturb the relation of the knife or chisel to the bone, and wound some structure not intended to be disturbed. The limb should then be rendered bloodless by means of an Esmarch's bandage. The limb should be thoroughly cleansed by means of soap, water, and brush, shaved and then washed with ether, in order to remove all grease. It is then wrapped in a towel wet in 1 – 1000 corrosive sublimate solution until ready for the incision.

Having selected the site of the incision, the bone should be reached as quickly as possible, by a sharp, clean incision, produced by a single stroke of the knife; other things being equal, the line of incision should be parallel to the fibres of the muscles penetrated. The bistoury should be maintained *in situ* to serve as a guide to the osteotome, which is inserted at its side. The osteotome is introduced in a line with the incision in the soft parts; when it reaches the bone it is turned to the direction that the osseous incision is to be made. In selecting a site for the incision in the soft parts, it should be made so as to avoid wounding any of the larger blood vessels. In the hand of the expert operator, the osteotome becomes a probe, and the sensations conveyed through the instrument enable him to ascertain all that could be known by the introduction of the finger.

The osteotome should be directed so as to cut away from any important structures that lie close to the bone; at the same time, the sides of this instrument being blunt, it may be used so as to lever aside the soft tissues, meanwhile keeping the cutting edge in contact with the bone. The osteotome is driven through the bone by pretty firm blows with the mallet. For this purpose I am in the habit of using a good-sized carpenter's mallet. After each blow the instrument is moved from side to side at right angles to the bone, in order to prevent its becoming too firmly wedged in the bone. In dividing large bones it is well to use in succession osteotomes of two or three sizes, commencing with the largest; the incision thus made corresponds more nearly to a wedge. Under no circumstances should the osteotome be used as a lever to pry the bone apart, as it will result in the

breaking of the instrument. The instrument should be grasped firmly in the left hand (Fig. 77), the border of which rests on the limb just above the wound. In this way the osteotome is under perfect control, and any deviation which might inadver-

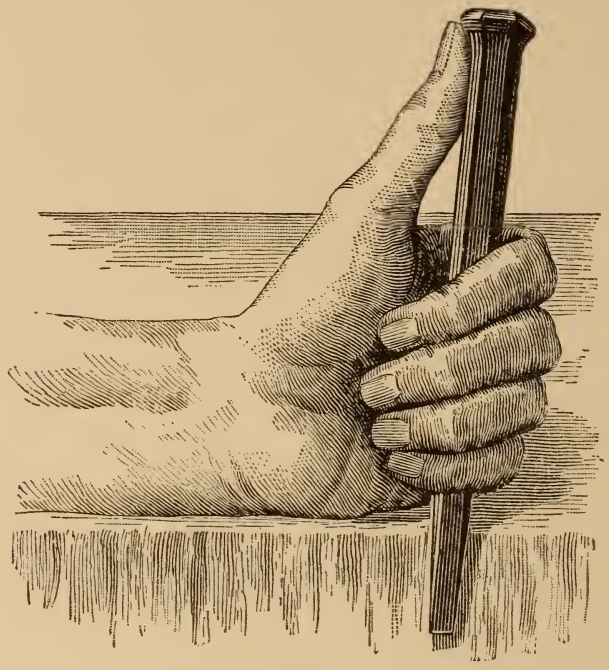

FIG. 77.

Manner of holding the Osteotome.

tently be given to it by the mallet can be instantly checked. The chisel should be made to traverse the deeper layers of bone in a fan-like manner. When the section of the bone is nearly completed, the osteotome is withdrawn and the deformity rectified by fracturing with the hands the remaining bridge of bone. During the section the wound should be kept wet with 1 – 2000 sublimate solution, or if there is any reason to fear that the antiseptics have not been perfect, on the removal of the osteotome, the small nozzle of an irrigator may be introduced and the wound irrigated with the sublimate solution. After the deformity has been corrected, a wet sponge is secured over the

wound with a few turns of a bandage, and the Esmarch bandage removed. The sponge should remain in place while the other limb is being operated upon or until the limb is ready to be dressed. The hemorrhage after a subcutaneous osteotomy is slight; I have never seen enough to cause any anxiety.

Cuneiform Osteotomy.—In anterior curvature of the tibiæ and angular curvatures of the long bones, a wedge of bone has to be removed in order to correct the deformity. For this purpose a chisel with a straight cutting edge on one side is used, and the section is made through an open wound. An Esmarch's bandage having been applied, an incision is made over the crest of the tibia parallel to the long axis of the limb directly down to the bone at the site of the greatest curvature. The wound should be large enough to admit the finger and to enable the operator to see what he is doing. I have sometimes made the incision at right angles to the axis of the limb. While this facilitates the operation, the hemorrhage is apt to be greater. The periosteum should be divided in the same line with the incision through the soft parts. It is sometimes recommended to make another incision at right angles to the first at its middle portion. This complicates the wound, and is of no material advantage. The periosteum should be well separated from the bone at the point where the wedge is to be removed. The size of the wedge that it is necessary to remove should be accurately determined before the operation, and marked off with a pair of calipers. When a large wedge is to be removed it is better to cut it out in several small pieces, first a small superficial wedge, then a small shaving on each side until the desired amount of bone is cut out. The shape of the normal bone does not afford a guide in the removal of the wedge, as the shape of the distorted bone is greatly altered in its contour. The deformed tibia will often be found greatly flattened from side to side. If the chisel be kept within the periosteum, important soft structures cannot be injured. If the size of the wedge has been accurately calculated, when the deformity is corrected the cut surfaces of bone will just come in opposition and may be held in position with a suture of strong catgut.

Dressing of the Wound. — After the circulation has become established, any bleeding vessels that are liable to cause trouble are to be secured with catgut ligatures. The edges of the periosteum are united with catgut sutures, a few strands of catgut placed at the angles of the wound for drainage, and the skin united.

It has been sometimes recommended that a counter opening be made at the apex of the wedge and several horse-hair drains inserted. Macewen treats the wound openly. The wound should be dusted with iodoform, and covered with a strip of Lister's protective. The limb is then enveloped in a mass of sublimate gauze and absorbent cotton, and neatly bandaged. After both limbs are dressed, a plaster bandage is applied and the limb suspended as in Fig. 78, — a method which I have found of exceed-

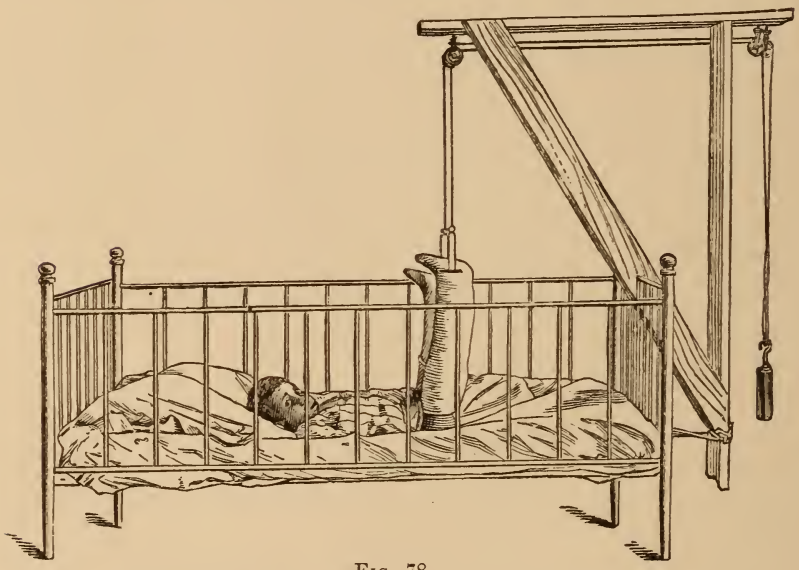

Fig. 78.

The Author's Method of Suspending the Limb after Osteotomy.

ingly great advantage in my practice. Macewen uses a splint consisting of a back, an outside and foot piece (Fig. 79), the padding being arranged so as to slightly overcorrect the deformity. The essentials for success are the maintenance of the

limb in a fixed straight position and the keeping the body at rest. I think these requirements may be more easily accomplished by the position which I suggest. The wound heals by first intention.

The wound may be left for three weeks, when the dressing should be removed and any slight remaining deformity corrected, and the limb dressed for another three weeks. I believe, however, that the best results can be secured by placing the limb in a temporary splint for twenty-four hours, when the dressing is removed and the limb put up in a permanent dressing and splint. It is often found that the first dressing becomes saturated and hardened by the dried blood, and loses its antiseptic properties.

Cases suitable for Operation. — Genu valgum, or knock knee, may be defined as a deformity at the knee joint, in which a line drawn from the head of the femur to the middle of the ankle joint passes outside the centre of the knee joint, and in which the internal malleoli cannot be made to touch when the limbs are in an extended position.

Several different operations have been proposed for the relief of genu valgum. The one which I think gives the best results is that of Macewen.

Fig. 79.
Macewen Splint.

In performing this operation the incision in the soft parts is made on the inner side of the limb, at a point where the two following lines bisect one another, — a line drawn a finger's breadth above the level of the upper border of the external condyle and in a line parallel to and half an inch in front of the tendon of the adductor magnus. By making the incision directly down to the bone it is impossible to wound any important structures. In July last, I had an opportunity of seeing that master of osteotomy, Dr. Macewen, perform his celebrated operation for genu valgum. A small quick incision, with a few

rapid strokes of the mallet the chisel divided the superficial shell of the inner surface of the femur; then the chisel was rapidly driven in a fan-shaped direction into the cancellous tissue of the bone, and the incision completed. The other limb was likewise operated upon with the same degree of rapidity and precision. The deformities were at once corrected, the limbs dressed and immobilized in a splint.

Curvatures of the tibia may be lateral, anterior, or antero-lateral. The bending may be confined to the lower third of the bone, just above the malleoli; it may involve the whole bone, or there may be a short curvature at its lower third and then a long one above, or the bone may have one long anterior curve. An anterior curve above the ankle and a compensatory posterior curve just below the knee is a frequent deformity. This deformity frequently gives rise to a condition of hyper-extension at the knee joint. In these cases, when the deformity is slight it may be corrected by a simple osteotomy, but when the deformity is pronounced a series of osteotomies, or the removal of several wedges, is necessary to rectify them. In one case I performed as many as eighteen sections of bone on one patient. In well-marked cases of anterior curvature after removal of a wedge of bone it will be found that the deformity cannot be overcome until the tendo achillis is divided subcutaneously. I have had to perform tenotomy in four cases. In only two cases, in which cuneiform osteotomy was performed, the skin wound failed to unite, owing to pressure of the splint, but in none of the cases has there been suppuration or non-union.

Case 1. — Lena H., aged twelve years. History of rhachitis. Marked genu valgum. When standing with the internal condyles of the femur touching, the feet were separated a distance of twenty inches. Jan. 8, 1885, supra-condyloid osteotomy of both femora. Recovery attended by no bad symptoms; in three weeks the dressings were removed, and the wounds found to be healed and the limbs in good position. At the end of the seventh week the patient was walking about.

Case 2. — Ruby H., aged eight years, sister of Case 1. Has marked genu valgum of rhachitic origin, in both limbs. When standing the feet were separated a distance of twenty-two inches.

January 8, supra-condyloid osteotomy of both femora. Antiseptic dressing, plaster splints, and suspension. Made an easy recovery. Redressed at the end of three weeks; wounds healed; limbs in good position.

Case 3. — James H., aged ten years. All the bone presented slight rhachitic changes. In the forearm there was a marked posterior curvature of the ulna and radius. On February 5 I performed subcutaneous osteotomy on both the ulna and radius, the limb was rectified and dressed with a plaster splint which was changed at the end of three weeks, when the wounds were healed, plaster re-applied for another two weeks. These three cases belonged to the same family. The mother has had seven children, all of whom are rhachitic.

Case 4. — Eighteen sections of bone. Jane S., nine years of age, entered the hospital in April, 1886. She was in a poorly nourished condition, and presented marked rhachitic deformities of all the long bones. The femurs present anterior and lateral curvatures, with great depression of the internal condyles. Below the knee, in both legs, there is a marked posterior curvature, with outward rotation of both tibiæ and fibulæ. About the middle portion of each leg there is a marked anterior and inward angular deformity of both bones of the leg. Just above the ankle there are marked anterior curvatures of both limbs. On April 24 I performed cuneiform osteotomy on tibiæ and fibulæ of both legs for the correction of the most marked deformities. The limbs were immediately put up in plaster splints; these were not removed for a period of three weeks, when the wounds were found to be healed and the worst deformity corrected. The plaster splints were re-applied for another three weeks, when they were removed and the patient was allowed to walk around. Fig. 80 shows the patient after these four osteotomies. Previous to the operation, on walking, the inner portion of the leg touched the ground. October 6, I performed Macewen's supra-condyloid operation on both femora; November 20, cuneiform osteotomy on both tibiæ and fibulæ; December 28, cuneiform osteotomy of right lower tibia and fibula. From all of these operations the patient has recovered without the least trouble, and there has not been a particle of suppuration in either

wound. She is able to walk with ease and comfort, and feels proud and happy. May 8, 1887, cuneiform osteotomy of tibia and fibula above ankle. June 2, cuneiform osteotomy of upper

FIG. 80.

Multiple Rachital Deformity after Partial Correction.

FIG. 81.

Multiple Rhachitic Deformity after Complete Correction, from a photograph of Case 4.

left tibia and fibula. October 12, cuneiform osteotomy of right tibia and fibula for posterior curvatures. Fig. 81 shows the final result.

Case 5. — Samuel E., aged nine years, presents a well-marked example of rhachitic deformity. The teeth are deficient. The femurs have an anterior curvature, and both internal condyles are much depressed. The tibiæ present several well-marked

lateral and antero-posterior curvatures. He walks with difficulty. There is also well-marked lordosis. On July 12 I performed Macewen's operation on both femora. Dressed as usual. Wounds healed when the dressings were removed at the end of three weeks. October 3, I performed cuneiform osteotomy on both tibiæ and fibulæ just above the ankle for marked lateral

Fig. 82.

Case of Bow Legs.

Fig. 83.

Case of Bow Legs Corrected.

curvature. November 3, dressings removed, wounds healed. A month later the upper tibiæ and fibulæ were operated upon for antero-posterior curvature.

Case 6. — Lena T., three years of age, was admitted September 5. She presented a well-marked example of bow legs. Subcu-

taneous section of tibiæ and fibulæ of both legs at the upper portion was performed October 5.

Case 7. — Frank P., aged eight years, presented a well-marked example of genu valgum. On October 4 I performed Macewen's operation on both femora; recovered without incident, splint removed at the end of five weeks.

Case 8. — Lillie D., aged three years. Well-marked example of bow legs; had been treated mechanically at one of the Brooklyn orthopedic dispensaries for over a year, but without material benefit. Nov. 18, 1886, I performed osteotomy on both legs, dividing the tibia and fibula. She made an uninterrupted recovery. Patient before and after operation is shown in Figs. 82 and 83.

Case 9. — James Lowery, aged four years, was admitted into the hospital with a marked curvature of both bones of the legs, especially prominent just above the ankle and below the tibial tuberosities. On November 27 I made a section of the fibulæ and tibiæ of both legs. The deformities at these points were corrected, but a slight angular deformity remained just above the ankle of the left leg. The parents were so well satisfied with the result of this operation, that they did not consider another operation necessary.

Case 10. — Edna F., aged three years. Entered the hospital March 2. An example of genu valgum. Macewen's operation April 14. Splints were removed at the end of five weeks, when the limbs were found to be in good condition.

Case 11. — Anne B., aged three years. Entered the hospital May 16. Outward curvature of the legs. Cuneiform osteotomy May 19. Recovery uninterrupted.

Case 12. — Frederick M., aged ten years. History of rhachitis. All the bones presented marked evidence of rhachitis. Teeth deficient, and all the long bones deformed. The femora presented anterior and lateral curvatures, with depression of internal condyles. The tibiæ were flattened with anterior and lateral curvatures. Cuneiform osteotomy of both tibiæ and fibulæ May 18, 1887, with correction of angular curvatures above ankle. In order to straighten the limbs I had to tenotomize both tendo achilles. Wounds healed without suppuration. October 13,

Macewen's operation for the correction of genu valgum. November 15, cuneiform osteotomy for correction of anterior curvatures of tibiæ. Patient discharged December 30, with limbs in good position.

Case 13. — Brunetta C., aged four years. Entered June 10. Compound rhachitic deformity. Cuneiform osteotomy on tibiæ and fibulæ of both legs June 30. October 25, Macewen's operation.

Case 14. — John Biorca, aged four years, was admitted August 14. On October 18 I performed Macewen's operation on the femur. Jan. 4, 1888, I performed double cuneiform osteotomy on tibia and fibula of left leg. On January 25 I performed similar operation on the right leg. April 6, cuneiform osteotomy of both tibiæ and fibulæ for posterior curvature.

Fig. 84.
Lateral View of Multiple Deformity.

Case 15. — Harry B., aged seven years. Entered October 19. He presented marked genu valgum and tibial curvatures. November 11, supra-condyloid osteotomy. Jan. 25, 1888, I made cuneiform sections of upper tibiæ and fibulæ of both legs after the manner of Volkmann, for correction of some remaining genu valgum and posterior curvature of tibiæ. April 12, cuneiform osteotomy of bones of both legs.

Case 16. — Bessie L., aged five years. When two years old, was treated for muscular debility and infantile paralysis. Supra-condyloid osteotomy October 20.

Case 17. — Lucy N., aged six years. Rhachitic history. Marked rhachitic deformity of legs. November 5, supra-condyloid osteotomy. January 24, cuneiform osteotomy of both

tibiæ and fibulæ for anterior curvature above ankle. April 30 cuneiform osteotomy of both tibiæ and fibulæ at the upper part for posterior curvature.

Case 18. — James N., aged four years. Rhachitic history. Complicated deformity of legs. November 11, I performed supracondyloid osteotomy on both femora. January 24, cuneiform osteotomy of both tibiæ and fibulæ for anterior curvature. April 30, cuneiform osteotomy of both tibiæ and fibulæ at upper third.

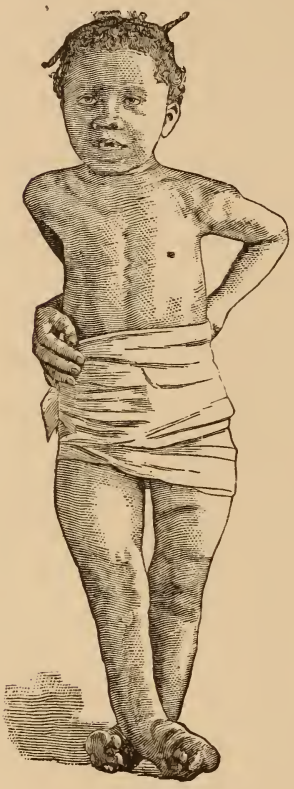

FIG. 85.

Typical Condition of Teeth in Rachitis.

FIG. 86.

Rachitic Deformity of Unusual Type.

Case 19. — Carrie H., aged seven years. Rhachitic history. Deformity well marked in tibiæ and fibulæ. Illustrated in Figs. 85 and 86. February 3, I removed a large wedge from both tibiæ and fibulæ for correction of anterior and lateral

curvature. In order to fully correct the deformity I had to tenotomize both tendo achilles. April 14, cuneiform osteotomy of tibiæ and fibulæ at upper third for anterior curvature.

Case 20. — Lizzie B., aged seven. Rhachitic history. Different portions of the body presented marked deformities of a rhachitic nature. The head was markedly elongated antero-posteriorly, and flattened from side to side. The upper and lower extremities presented various deformities of a complex nature. February 25, double cuneiform osteotomy of both legs above the ankles for anterior and lateral curvature. April 25, double supra-condyloid osteotomy. June 29, section of both ulnæ and radii for posterior curvature.

Case 21. — Charles T., aged seven years, presented a very aggravated type of rhachitic deformity. February 25, double cuneiform osteotomy at the lower third of the legs for marked angular deformity. The operation of double osteotomy by the supra-condyloid method was done April 28. June 29, section of both ulnæ and radii for marked curves in the forearms. Recovery from these several operations was perfect.

Case 22. — Elizabeth J., aged twelve. Genu valgum with anterior curvature of tibiæ. April 24, supra-condyloid osteotomy. June 19, section of both tibiæ and fibulæ. Deformities corrected.

Case 23. — Pasquel Lamonti, born of Italian parents. Aged five years. Rhachitic history. Genu valgum. Malleoli separated ten inches. Posterior curvature of tibiæ. Rhachitic spine. January 4, supra-condyloid osteotomy. April 20, cuneiform osteotomy of both tibiæ and fibulæ. Plaster dressing. Recovery normal.

Case 24. — William D., aged five. Typical form of genu varum. September 6, section of tibia and fibula of each leg at two points. Deformity corrected. Antiseptic dressing and plaster splint. Dressings and splints removed at the end of eight weeks.

Case 25. — Tommy Forman, aged 5. Exaggerated form of bow legs. September 10, section of both tibiæ and fibulæ at the upper and lower angles of the curvature. Antiseptic dressing and plaster suspension. Dressing removed at the end of eight weeks, wound healed, and deformity corrected.

Case 26. — Wm. J., aged twelve years. A typical example of genu valgum. Malleoli separated twenty inches. January 20, supra-condyloid osteotomy. Plaster dressing and suspension. Temperature normal.

Case 27. — A. M., aged four. Genu valgum. December 2, supra-condyloid osteotomy. Plaster dressing and suspension. Dressings removed at the end of the seventh week.

A NOTE ON THE USELESSNESS AND HARMFULNESS OF SHOULDER-STRAPS, SHOULDER-BRACES, AND HOC GENUS OMNE, FOR ROUND SHOULDERS, STOOPING, AND INCIPIENT LATERAL CURVATURE OF THE SPINE.[1]

BY BERNARD ROTH, F.R.C.S., ENGLAND.

When we find an able surgeon like Mr. Walsham, surgeon in charge of the Orthopedic Department of St. Bartholomew's Hospital, London, not only advocating shoulder-braces, but even inventing a new one, still more injurious than most of its predecessors because of its greater strength from being manufactured of solid rubber bandage,[2] one feels inclined to rub one's eyes and to ask whether scientific orthopedic surgery is really advancing or whether we have gone back half a century or more.

John Shaw, that enlightened and able author of a more rational treatment of Lateral Curvature, whose works I have read again and again with ever-increasing pleasure and profit, criticised shoulder-straps as follows:[3] —

"The effect which this instrument [shoulder-brace or common back-collar] produces in ordinary cases may be easily comprehended. . . . If the scapulæ be brought close to the spine by the straps of the brace and kept constantly so, there can be no use for the several strong muscles which pass from the spine to the scapulæ. They must consequently waste and become nearly useless, while those on the fore-part of the chest, being excited to resist the straps, will become increased in power; and hence, when the brace is taken off, not only will the shoulders fall forward as in a delicate person, but

[1] Read by title before the American Orthopedic Association at its second annual meeting.

[2] See the *Lancet*, May 3, 1884, "On a new Form of Shoulder-brace for the Treatment of Stooping Habits, Incipient Lateral Curvature," etc.

[3] Further Observations on the Lateral or Serpentine Curvature of the Spine: being a Supplement to the Work on Distortions of the Spine and Bones of the Chest. London, 1825.

the muscles on the fore-part of the chest will predominate over those by which the scapulæ should be held back and *pull* the shoulders forward."

This was written upwards of sixty years ago, and is so complete and simple a refutation of any supposed efficacy of shoulder-straps for stooping habits that I have little to add to John Shaw's scientific common-sense.

I have observed in numerous instances where shoulder-braces have been worn for several months or longer, and where from misplaced perseverance and severity they have been worn extra-tightly, that the unfortunate wearer has tried to obtain relief from the excessive pressure of the straps over the coracoid process and adjacent clavicle on each side, by throwing the whole upper trunk backwards by undue arching of the loins, with the result of producing severe lumbar lordosis in addition to the dorsal cyphosis for which the apparatus was being worn. I am quite aware that dorsal cyphosis is generally accompanied by compensatory lumbar lordosis; but in these cases to which I refer, the lumbar hollow is much severer than usual, and causes an exaggerated thrusting forwards and prominence of the abdomen. Of course I am referring to the cyphosis of muscular debility, and not to that due to spinal caries. In spite of these facts, ninety-nine out of one hundred medical men of the present day are in the habit not only of allowing but even of advising patients to wear these instruments of torture. I understand that large fortunes are being made by the sale of those popular American and other shoulder-braces which are so largely advertised at the present time.

The only way in which shoulder-straps might be worn with benefit (not that I ever recommend them) is well illustrated by the following anecdote which is also culled from good old John Shaw. An eminent surgeon was consulted by a gentleman who became one of our first tragedians, as to the best mode of correcting a stoop which he had acquired. The surgeon told him that neither stays nor straps would do him any essential good, and that the only method of succeeding was to recollect to keep his shoulders braced back by a voluntary effort. But the tragedian replied that this he could not do, as his mind was other-

wise occupied. The surgeon then told him that he could give him no further assistance. Shortly after this conversation, the actor ordered his tailor to make a coat of the finest Kerseymere, so as to fit him very tightly when his shoulders were thrown back. Whenever his shoulders fell forward, he was reminded, by a pinch under the arms, that his coat cost him six guineas and that it was made of very fragile materials; being thus forced, for the sake of his fine coat, to keep his shoulders back, he soon cured himself of the stoop. He then showed himself again to the surgeon, who ever afterwards, when consulted whether young ladies should wear shoulder-straps, permitted them, on condition that they were made of fine muslin or valuable silk, for tearing which there should be a forfeit!

I have not referred to the Therapeutics of Round Shoulders, etc., because my articles "Lateral Curvature," "Antero-posterior Curvature," etc., in Heath's "Dictionary of Practical Surgery," will enable any surgeon who follows the lines of treatment there indicated, to cure every case of stoop that presents itself in a few weeks, provided he meets with the willing co-operation of the patient.

My pleasure in acceding to Dr. Gibney's request to contribute a paper to this meeting of the National Orthopedic Association of the United States of America will be increased if I am able to convince some of the members that shoulder straps and braces are not only useless, but also injurious when prescribed for weak backs.

DOUBLE HIP DISEASE.

A Report of Fourteen Consecutive Cases, with Conclusions.[1]

BY JOHN RIDLON, A.M., M.D., NEW YORK.

Hip Disease affecting both joints simultaneously is fortunately not of frequent occurrence; and in such cases it is with dread that the surgeon looks forward to the long period of confinement in bed, the risks to life, and the resulting deformity.

It has been my fortune to treat, for a longer or shorter period, fourteen such cases; and it has seemed to me that it might not be wholly unprofitable to give brief notes of these, and to draw therefrom conclusions as to prognosis and treatment.

Case 1. — Female, five and a half years old; first seen Jan. 4, 1884. Good heredity. In October, 1882, she began to limp and have pain in the left leg; there was slight flexion. About two weeks later a long-traction splint was applied. The patient went about very comfortably for nine months, when pain came in the right leg, and a double long-traction splint was applied. It was five months after this when the child came under my care. Both thighs were flexed to about 135°, and held very rigid by muscular spasm; the left was somewhat adducted. There was no sign of abscess, and no very great tenderness about the joints on gentle manipulation. The patient was put in bed with the legs on an incline, and traction was made by the double hip splint in the line of the deformity. It was found impossible to keep the child from constantly sitting up in bed during the day. It was, consequently, some four months before the flexion was overcome. Then, at the urgent request of the parents, she was allowed to go about with the splint and crutches. Soon a considerable degree

[1] Read by title, at the meeting of the American Orthopedic Association, Washington, D.C., Sept. 20, 1888.

of flexion returned; but because of the difficulty of controlling the movements of the child, and from lack of co-operation on the part of the parents, it was not deemed worth while to again put her in bed. After she had been under my care some eighteen months, an abscess appeared on the anterior surface of the thigh, in front of the joint. This increased so slowly that when, in September, 1886, she passed from under my care, having moved to a neighboring city, it was only about 2 x 3 inches in superficial area. During all this time the patient's general health was excellent; appetite was good, the sleep quiet, and there was no complaint of pain. I have recently learned that she died in July, 1887, of tubercular meningitis.

Case 2. — Female, eighteen and a half years old; first seen Jan. 5, 1884. Good heredity. Cause unknown. Trouble began in left hip three and a half, and in right two and a half years ago. Symptoms, pain at night and drawing up of the legs. General health always poor, in spite of living in the country in a high and healthy locality. Was without treatment up to five months ago, but got about on crutches when she was able to be out of bed. Four months ago she underwent an operation: the adductors of the left leg were divided and the adduction nearly overcome under ether; much of the deformity has, however, returned. Recently she has been going about on crutches again.

Examination. Right thigh flexed to about 135°. There is no motion at the joint. The muscles are contracted and become more tense when motion is attempted. There is a slight degree of abduction. The left leg is flexed to about the same degree, and adducted so that the knee touches the right thigh. There is slight motion, and muscular spasm. The right great trochanter is one and a half, and the left two inches above Nélaton's line.[1]

She was treated in bed two and a half years with a double long-traction splint. Her general health improved all the time; she

[1] The author believes that Nélaton's line is not a trustworthy guide as to the normal, or abnormal, location of the great trochanter when the thigh is flexed and abducted or adducted; and that the above measurements do not prove a subluxation, or erosion to that degree.

was well nourished and in good color. The right leg was in the same position as when treatment was commenced. There was less muscular spasm. The left leg was somewhat less adducted, and there was slight possible passive motion. From this on there was no treatment. Patient went about on her crutches. A year later (June, 1887) both hips appeared to be ankylosed; the right in the position last noted, and the left slightly more adducted. Patient walked with one crutch without much difficulty. On Feb. 23, 1888, the patient was delivered, in the Sims position, of a child weighing $7\frac{1}{8}$ lbs. No inflammatory symptoms at the hip joints following.

Case 3. — Male, ten years old; first seen June 4, 1884. Good heredity. Disease has existed at right hip five years, at left hip four years. There has been *no treatment*. There are four sinuses leading towards the right hip joint, and three towards the left. All have been discharging for three or more years; and during this time the patient has not left his room. He has not been kept in bed, but has played about the floor when so inclined. Early in the disease and during the formation of abscesses there was pain; none has been complained of since the last abscess formed, over three years ago. The general health is good, and has been all the time since the cessation of pain. Both thighs are flexed to about 130°, but there is scarcely any lateral deformity; the knees are separate $3\frac{1}{4}$ inches. No motion can be detected at either joint, and no pain is felt when it is attempted. No treatment was attempted, and the patient was allowed to go on in his own way. He was seen from time to time. After four years the sinuses are all closed, and there is no change in the position or motion at the joints. There seems to be little doubt about there being ankylosis at both joints.

Case 4. — Female, nine years old; first seen Oct. 20, 1884. Good heredity; cause unknown. When six years old, began to limp and have pains in right leg; after about six months an abscess appeared, which was allowed to open spontaneously and discharged for about two months. After about a year a long-traction splint was applied. This she was wearing when she came under my care. The right leg was markedly flexed, rotated in and adducted, and held rigid. No movement could be

made out at the joint. The left leg is abducted and rotated out, but not flexed; there is much thickening of all the soft parts about the upper thigh. There is but little motion at the joint. Attempted movement causes pain; otherwise there is no pain. After two months an abscess appeared on the outer side of the thigh, and the single traction splint was replaced by the double. The patient had meantime been kept in bed, and this confinement was continued. The abscess was allowed to open spontaneously, and discharged for about two months. After being confined to bed for a year and a half without any change in the degree of flexion and adduction of the right limb, it was considered probable that this joint had recovered with ankylosis. The splint on that side was accordingly removed, and the patient allowed to go about the room.

In May, 1887, the patient passed from under my care. The mother now (September, 1888) tells me that she has had no professional care since that time, and that she removed the splint soon after. Examination now shows no motion at either hip. Right flexed to about 135°, adducted about 20°, and rotated in; the left is not flexed, is slightly abducted, and rotated out. Distance from right anterior spine of ilium to right inner malleolus, 30¼ inches; left, 30 inches. Distance from umbilicus to right inner malleolus, 32 inches; left, 35¼ inches. Both hips appear to be cured with ankylosis. Confinement in bed for two years and to the room for three years did not injure the general health.

Case 5. — Female, two years nine months old; first seen Nov. 11, 1884. Consumption on paternal side; otherwise good heredity. About six months ago began to limp and have pain in right leg. About two months ago began to have pain in left leg, and for a month has been unable to walk. Pain has grown rapidly worse of late until she was unable to sleep. A week ago a double long-traction splint was applied, but she still has much pain. Both legs are flexed to 90°, somewhat adducted and held rigid by muscular spasm. The slightest movement of either leg causes great pain. No sign of abscess. The legs were put on an incline, and the shoulders elevated so as to form an angle of 90°. Traction was made in this line with the double long-traction hip

splint. The pain rapidly subsided, and after six weeks the flexion was reduced. From this time on the patient was treated in bed with the traction apparatus, but no provision was made against her sitting up; and this she did pretty constantly, as the pain and rigidity passed off. For two years and nine months she was kept in bed; and although living in a malarious region and passing through scarlatina, whooping-cough, and diphtheria, her general health has remained good. During the summer of 1887 she was allowed to stand on her splint, and got about by the help of the chairs and wall. At this time there was no flexion in either leg. There was motion in the left hip through perhaps 10°, and in the right through half that distance.

In June, 1888, there having been no pain for some three years, and no tenderness in the left hip for about a year, and in the right for six months, the traction splint was removed from the left side, but continued on the right side. Both legs are somewhat flexed, but there is a little passive motion possible at both joints. August 24, 1888, eight weeks after the left splint was removed, the following notes were made: There has been no pain. There is no tenderness in either hip on reasonably severe manipulation and palpation. It is doubtful if there is any motion at either joint. Nevertheless, she walks remarkably well with splint on right side, without either crutch or cane.

Flexion of right thigh, 36°; flexion of left thigh, 30°. Measured according to the plan of Dr. George L. Kingsley.

Distance from right anterior superior spine of ilium to right malleolus, 22¼ inches. Distance from left anterior superior spine of ilium to left malleolus, 23½ inches; from umbilicus to right malleolus, 25 inches; from umbilicus to right malleolus, 25½ inches. Actual shortening of right leg, 1¼ inches. Apparent shortening of right leg, ½ inch. This is gained by the abduction of the right and adduction of the left leg through 7°. Measured according to the plan of Dr. R. W. Lovett.

Case 6. — Male, three years old; first seen March 21, 1885. Born in Russia-Poland, and no clear history can be obtained. There has been trouble at the right hip for but a short time (perhaps two or three weeks). The right leg is flexed to about 130°, adducted, and held rigid by muscular spasm. Attempted

motion causes crying. A long-traction splint was applied on April 8, 1885, and the patient put in bed with the leg on a pillow. The pain subsided and adduction was rapidly reduced, but flexion remained, as parents would not keep the child lying down.

On August 4, after being in bed four and a half months, disease was discovered in the other hip, as evinced by flexion, pain, and tenderness, and reflex spasm limiting motion. On August 18 a double long-traction splint was applied. From this on the patient was free from pain, and the case progressed favorably. The general health was good, although kept in bed for nine months in a small room in a poor tenement. The patient passed from under my care on Dec. 18, 1885, going to Dakota.

Case 7. — Male, seven years old; first seen August 24, 1885. Good heredity. Had a fall two months ago, and has limped from time to time since. No pain; good appetite; sleep quiet. Right leg flexed to 135° and abducted. No shortening; one-half inch atrophy of muscles of right thigh. Treated by weight and pulley, with leg on an incline, for four weeks; by long-traction hip splint, with leg on incline, for six weeks (up to October 15). On October 1 fluctuation was detected in right groin. On October 15 pain appeared in left side; flexion, abduction, and rotation out of thigh; muscular spasm, limiting motion, and pain on attempted motion. From this on there was no mechanical treatment, but the patient remained quiet in bed in the supine position.

After five months the inflammatory symptoms had disappeared from the left hip; there was still flexion, abduction, and outward rotation, but the position and rigidity seemed to be the result of immobilization rather than inflammation, and gentle passive motion was commenced. On the right ride the abscess had slowly increased, but the pain and tenderness were gone. Gradually he gained the use of the left leg, and was able to get about on crutches. On Dec. 6, 1886, the abscess opened spontaneously, and discharged for three days, when it closed and has since remained so. The flexion, abduction, and outward rotation diminished; and on Feb. 21, 1887, a long-traction splint was applied to take the place of the crutches as a protective agent. On Oct. 15, 1887, the joint was cured, in good position and with considerable motion. The left joint had normal position

and motion. Up to the present writing (September, 1888) there has been no relapse. The confinement of the patient in bed in a small room in a tenement house for fourteen months did not in any degree interfere with the general health.

Case 8. — Male, seven and a half years old; first seen March 25, 1886. Father died of consumption; other hereditary history good. Has had hip disease, left side, for about a year, and has been treated by a long traction splint. The thigh is flexed to about 145°, and somewhat adducted, and there is well-marked muscular spasm, completely limiting motion in every direction. There is very little tenderness on palpation or attempted passive motion. For the past month he has complained at times of pain in the right leg, and has been restless at night. There is well-marked muscular spasm when the thigh has been moved through about one third its normal extent of motion in all directions. No tenderness on palpation. Slight flexion and abduction. He was treated for nine weeks by a double long-traction splint. Pain ceased, and deformity was reduced.

He then moved away, and the mother removed the apparatus after a few weeks, and he has since remained without apparatus. He has been kept in bed only when the pain has been severe. About two months after the splint was removed an abscess appeared at the right hip, opened spontaneously, and discharged for about nine months. The present condition is as follows: Both thighs flexed to about 130°, the left adducted, the right abducted. There is no motion at the left hip joint, and but very little at the right. No tenderness on palpation, or pain on attempted passive movements. The limitation of motion does not seem to be due to *reflex* muscular spasm.

Case 9. — Male, four years old; first seen Oct. 11, 1886. Good heredity on mother's side, but on the father's side there is a suspicion of syphilis. About a year ago became stiff in movements, and deformity appeared in the dorso-lumbar spine. There was pain in the legs, and psoas abscess on right side. He was treated by a Taylor spinal brace, and apparently cured. He has not worn a brace for some months, and there is no deformity or rigidity in the dorso-lumbar spine (where the pad plates are located on the brace). There is, however, an angle, with

rigidity, at the junction of the fifth lumbar vertebra with the sacrum.

About six months ago trouble began in the left hip, and soon after in the right. An attempt was made to treat him with a double hip splint, but the suffering was so intense that it was abandoned, and he has been without treatment. Left thigh flexed to 130°, slightly adducted; right not flexed quite so far and not adducted; both held rigid by muscular spasm. Suffers very great pain. An attempt was made to treat him in bed with weight and pulley, but after ten days this was abandoned and he passed from under my care. After a time he was admitted to a general hospital and treated in bed for many months, until the spine and right hip recovered. Then a Sayre long-traction splint was applied to the left leg, and he was allowed to go about.

On April 7, 1888, he again came under my care. There is a slight angular kyphos at the junction of the fifth lumbar vertebra with the sacrum. No spinal rigidity except at this one articulation. The right hip joint has free, painless motion to the normal limits. The left thigh is flexed to 135°, adducted about 10°; and there is a discharging sinus at the upper outer thigh; joint held rigid. Treatment in bed with leg on incline for eight weeks, reduced flexion and adduction, since which he has been allowed to walk around. The discharge from the sinus has stopped, and there is free motion at the joint through about 10°, no adduction, and but little flexion.

Case 10. — Female, nine years old; first seen Sept. 17, 1887. Good heredity. Has had hip disease, left side, since she was two years old, and has been treated all this time by a long-traction splint. For the past year has had, at times, pain in the right leg. This has recently grown much worse, and she has refused to walk. The left leg is flexed to about 135,° and somewhat adducted; there are three sinuses leading towards the joint, and the joint is held rigid by muscular spasm. The right side is flexed to about the same degree and abducted; there is some passive motion possible, but it gives pain and the muscular spasm is marked. There is a fluctuating swelling below the great trochanter. A double long-traction splint was applied,

and the patient put to bed with the legs on an incline. The pain soon subsided, but the flexion remained about the same, — it was found impossible to prevent the patient from constantly sitting up. The abscess on the right side gradually increased for four months, until it occupied the upper half of the thigh on its outer and anterior aspect. Then it began to gradually diminish, until now it is a firm, non-fluctuating mass of about $2\frac{1}{2}$ x 3 inches in superficial area. The degree of flexion is about the same on both sides, — 135°. On the left there is no motion; on the right the patient can flex the thigh through about 20° without pain. She remained in bed ten months, but since then has been getting about on splint and crutches. The general health is good, and has been all these years when free from pain.

Case 11. — Female, six and a half years old; first seen Sept. 30, 1887. Good heredity. In January, 1886, after a severe attack of measles, she began to limp and complain of pain in the right leg. For this (hip disease) she was treated at a public charity in New York City. Six months later she began to complain of pain in the left leg, and refused to walk. She had great pain, and was scarcely able to sleep. Both legs were flexed to 140° and adducted, the right most, so that the knees were in contact. Muscular spasm was intense, and the slightest movement in either lower extremity caused screams of pain. It was with the greatest difficulty that adhesive plasters were applied, weights attached, and the legs put on an incline. After three weeks the adduction and nearly all the flexion subsided, and there was free painless motion at both hips, through a few degrees, when the leg was grasped and traction made. Soon after that the patient passed from under my care, and I next saw her on August 29 of this year (1888). The mother tells me that during these past ten months she has been treated in bed with the legs on an incline, and with weight and pulley to each leg. Her general health has been good, and she has been free from pain until the past few days. Both legs are now flexed to about 135°, the left abducted and rotated out, the right abducted and rotated in. There is a fluctuating swelling (abscess) occupying the upper and outer portion of both thighs, and there is tenderness to gentle pressure about the great trochanter on each side. Motion

was not tested. The perineum is enormously broadened on each side; somewhat more on the left than on the right, because of the abduction of the left and adduction of the right thigh. The appearance is the same, but in greater degree, as is found in double congenital dislocation of the hips, and is the same as has been observed in hip disease when spontaneous dislocation occurred (in connection with abscess).[1] So positive did I feel that dislocation existed that I did not feel justified in subjecting the patient to the pain necessary to make out the actual location of the head of the bone.

Case 12. — Male, four years and eight months old; first seen Oct. 10, 1887. Father had pulmonary tuberculosis and secondary syphilis when patient was born; but the mother was healthy, and had no syphilis, — she nursed the child. When six months old, right hemiplegia occurred. The arm and side recovered, but the leg did not. Just before he was four years old Pott's disease in the upper lumbar spine was discovered; three months later, disease at the left hip joint, and two months after that at the right hip joint. Abscess appeared in connection with the left hip very early, and was several times aspirated; at the right hip an abscess appeared about two months after the first symptoms were noted. When he came under my care he was well nourished and free from pain when lying in bed with weight and pulley to both legs. There was a rounded kyphos involving five vertebræ in the dorso-lumbar region. Neither thigh was flexed; the right was slightly abducted, and the left adducted. There was on each thigh a large abscess, occupying the upper anterior and outer portions. Only very slight possible motion at either joint, and the attempt caused pain; this was most marked in the left leg. He was treated in bed by weight and pulley to each leg. The abscess on the right leg opened spontaneously and discharged for five months, since which it has remained closed; that on the left side grew gradually smaller, and now can no longer be felt; there is an abscess pretty well filling the left iliac fossa; movement in the right leg is free and painless

[1] This has been noticed by English observers while a patient was wearing a Thomas splint, and I have observed it in one case while the patient was being treated in bed with the Taylor long-traction splint.

through about 20°, and there is no longer muscular spasm. It is believed that this joint is well. At the left hip there is a little motion, and muscular spasm persists; but there is no longer any pain when traction is omitted or on moderately rough handling. Absolute confinement to the supine position in bed for over a year has not proved injurious to the general health. He is plump and of good color, and eats and sleeps well.

Case 13.—Male, six years old; first seen Jan. 5, 1888. Good heredity. Has limped and had pain in left leg at times for six months. For six weeks has been disinclined to walk; has been restless at night; appetite has failed, and he has grown thin and anxious-looking. There is no deformity in right lower extremity. It is possible to passively flex the thigh on the pelvis to 90°; beyond this point attempt at flexion causes flinching. The other movements at the joint can be passively executed to about two thirds their normal extent, when flinching supervenes. There is no fulness or tenderness about the groin or great trochanter. The left thigh is held flexed at about 135°, and beyond this it cannot be extended; there is a little motion on passive flexion and rotation; no pain on gentle manipulation; muscular spasm well marked. There is some thickening back of the great trochanter, with tenderness on deep pressure.

A double Thomas hip splint was applied. The flexion of the left leg was reduced at the end of ten days. From this time on, the patient was kept in the splint in the horizontal position (in bed, on a lounge, or in a carriage). Not once was he allowed to stand or sit, and not once did the *curiosity* of the surgeon lead him to loosen the straps passing around just above the patellæ and confining the legs to the splint, for the purpose of "testing the amount of motion in the joints." The appetite increased, sleep became quiet and restful; and he gained flesh, color and good spirits, and did not seem to mind his confinement.

On August 24, seven months and nineteen days after the treatment was commenced, the splint was removed for examination. At the right hip joint there was normal motion, both active and passive, in all directions, without pain, flinching, or muscular spasm. The left leg could be flexed to 90°, beyond which there was some flinching, but no well-marked muscular spasm; the

extent of the other movements was about two thirds the normal. There was no longer any thickening or tenderness about the great trochanter. The double splint was replaced by a single one for the left leg.

Case 14. — Male, ten years old; admitted to my service at St. Luke's Hospital, June 20, 1888. Good heredity. Trouble began about five years ago in the right hip, and soon after in the left. About two years ago an abscess appeared at left hip, and opened spontaneously a little below the great trochanter. This discharged for some months. After it closed another appeared on the inner aspect of the thigh, and opened spontaneously. This has discharged a little, from time to time, since. There has been no pain for a long time. He has been treated at home during all this time with a double long-traction splint. He was kept in bed until about a year and a half ago, since which he has been allowed to go about the room on his splint with the help of crutches. During the five years' treatment, confined to a small room of a very poor tenement, most of the time in bed, his health has been as good as possible, better indeed than any of his half-dozen brothers and sisters who have had the liberty of the street.

Both legs are flexed to about 130,° and the left adducted. Both are very rigid; there does not appear to be any motion at the hip joints. There is no tenderness about either joint, and no pain on moderately severe attempts at passive motion. Measurement: Right anterior superior spine of the ilium to the inner malleolus, 22¾ inches; left anterior superior spine of the ilium to the inner malleolus, 23⅜ inches; umbilicus to right inner malleolus, 25¼ inches; umbilicus to left inner malleolus, 25¾ inches. Allowed to go about the ward.

July 10. There is more adduction, especially of left leg.

July 28. Thomas's double hip splint applied, extending only to the knees.

September 1. No increase in flexion. Splint restrains adduction. No pain, and general health excellent.

From a study of these cases I have been led to the following conclusions: —

The disease seldom *begins* in both hip joints at the same time; and the *second* joint may become diseased while the patient is

resting in bed under treatment for the *first* joint. In other words, *traumatism* can be excluded from the elements of causation of the disease in the second joint in very many cases.

The joint that is first affected is often the last to recover. This would seem to be due to the fact that before *both* joints are involved and after one has recovered, the patient is allowed to walk around, giving the *one* diseased hip both pressure and motion, thereby delaying the cure and favoring ankylosis with flexion and adduction.

The duration of the disease in the *first* hip is usually somewhat less than that of the average case of hip disease, while the duration in the *second* hip is usually much less than that of the first. This, it seems to us, can only be accounted for by the fact that during the time that both hips are involved the patient is kept pretty rigidly in bed, thus removing the superincumbent weight and by that much diminishing joint destruction.

It has been thought by some observers that a second focus of disease has some derivative effect upon the first, thus: if, in a patient suffering from hip disease, we have Pott's disease develop, the hip will recover sooner than it could reasonably be expected to under ordinary circumstances. There does not, however, appear to be any valid evidence of this "derivative action," since, where two similar joints are affected, as the hip joints, the last affected is soonest well; and we are therefore inclined to attribute the beneficial effect which the second has upon the first solely to the increased amount of rest which is necessarily enforced.

Freedom from pain has been uniformly gained by rest in bed and the weight and pulley. This device alone, however, is not sufficient to prevent flexion, adduction, or spontaneous subluxation in connection with abscesses. The application of the double long-traction splint is much more effective. It sooner relieves pain; it permits of less movement at the joints, and the consequent ultimate flexion and adduction; and it can be used when supplemented by crutches, as an aid to locomotion, long before the joints unassisted could sustain the superincumbent weight. It does not, however, prevent the patient from assuming the sitting posture in or out of bed, and consequently does not pre-

vent a recovery with the legs flexed; neither does it prevent abduction and adduction and ankylosis in either position. This is probably owing to there being a greater degree of muscular spasm in one set of adductors than in the other, or because spasm remains in the adductors of one thigh for some time after it has subsided from the adductors of the other thigh; and since the legs are held parallel to each other, the pelvis tilts and one extremity is adducted and *apparently shortened*, and the other abducted and *apparently lengthened*. And this is exaggerated if the patient be allowed to walk about; for as the patient swings his legs forward between his crutches, the adductors come more strongly into play than the abductors, and a cure with more or less of the "scissor-legged" deformity results. If, however, the tendency to adduction be on but one side, and that the leg which is actually the longer; or if adduction is the result in the longer leg and abduction in the shorter leg, this *real* deformity becomes a less *apparent* deformity, and is a thing to be desired. So when one joint recovers with some motion before the other, which gives promise of having no motion, it is desirable to continue for some time the use of the long-traction splint without any high shoe on the well side, to induce, if possible, the position of abduction. It would also seem that the double long-traction splint gives less good results when used as an aid to locomotion than when used upon a patient confined to bed during the active stage of the disease.

The double hip splint of Hugh Owen Thomas serves a better purpose. It prevents flexion and adduction and abduction. If the patient recover with ankylosis in one or both joints, it is without flexion and without *apparent* lengthening or shortening. Obviously it does not affect the *real* shortening. It prevents the child from assuming the sitting posture, and thereby prevents the motion which is very trying to the surgeon and very harmful to the patient; and as a result the duration of disease is shortened, and the tendency to, and duration of, the suppurative process and all its risks are diminished. Then, again, it does not permit of any locomotion until the joints are sufficiently well to bear the superincumbent weight without pain, thus diminishing the tendency to relapse. It is a very convenient apparatus for

the nurse, since in it the child can without pain be carried from bed to lounge, or to another room, or to a carriage for a turn in the open air. By its use it may reasonably be expected that almost every child will ultimately recover without any deformity other than shortening due to actual erosion, and that a very large number of joints will recover with more or less complete motion.

A patient may go on, without treatment, to a perfect cure; but the result usually is ankylosis, with more or less adduction of one or both legs. This, however, is not a bar to locomotion; neither, in females, is it a bar to impregnation and safe delivery.

The more absolutely quiet the patient be kept, and the longer the period of quiet, the shorter will be the duration of the disease and the better the ultimate result.

If the patient be kept in bed and the joint even moderately at rest, abscesses less frequently form, and if already formed less frequently go on to aspiration, incision, or spontaneous opening than when he is allowed to walk about.

The dangers to the general health from confinement in bed, provided the patient be free from pain, may be disregarded, since all of these cases improved in health during the time of their confinement. We would not underrate the benefit derived from pure air and sunlight, and these can be obtained with perfect comfort and safety when Thomas's splint is used.

The danger to the life of the patient from so serious a disease as this would not seem to be great. Only one of these cases, so far as I can learn, has died (Case 1), and that from tubercular meningitis supervening at a time when the general health was good.

ON SOME OF THE DEFORMITIES OF THE TARSUS IN CONGENITAL EQUINO-VARUS,

With a Description of the External Lateral Traction Apparatus.

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We are all acquainted with the difficulties that sometimes attend the treatment of many of the apparently simple cases of congenital equino-varus. If we regard these cases from a purely objective standpoint, it seems a not very difficult matter to relieve the deformity. The resisting gastrocnemius muscle and the tense plantar fascia offer a well-defined and definitely located resistance to the reduction of the deformity; and our prognosis is too frequently based upon these easily determined elements of resistance, coupled with the degree of mobility that may exist at the ankle and tarsus. But a long record of failures point to the fact that there are some elements of resistance in these cases which cannot always be easily determined, — elements which are beyond the reach of ordinary diagnostic measures, and which have not always been removed by even the most radical operative procedures.

My studies in this interesting field have led me to seek a remedy for some of the difficulties that present themselves in congenital equino-varus, which will insure more uniform and better results; for I feel that all of the cases of this class, if treated before the age of puberty, should recover with straight feet. And I have felt for the past fifteen years that if a properly applied force could be utilized in these cases, very few, if any, would require operative treatment. In brief, I feel that while much ingenuity has been expended in devising and perfecting the various cutting methods of treatment, the apparently

simple but really more difficult mechanical methods which promise so much better results have been in many cases neglected.

It also strikes me that, as orthopedic surgeons, we take too much for granted, — that there is not enough original research and study among those who practise orthopedy. The anatomy, both normal and pathological, as well as the mechanics of the articulations, claims more of our attention than has been devoted to it. The surgical aspects of chronic deformities are, as we all know, so well taught that it is easy enough to apply the knife, the saw, the chisel, or the osteoclast, if we have occasion to use them. But who is there among us who has completely mastered the subject of the mechanics of the articulations? I cannot help thinking that the next generation of orthopedic surgeons will do less operating than is now practised, and that the much neglected subject of applied mechanics will receive the attention it demands.

There is one popular fallacy in the pathological anatomy of congenital equino-varus that has not received the attention it deserves.

We are taught that there is no lateral motion at the ankle joint; that the articulation between the inferior articulatory surfaces of the tibia and fibula and the superior and lateral articulatory surfaces of the astragalus permits only antero-posterior motion, except in extreme extension. As a consequence we have been taught by many eminent teachers that in congenital equino-varus the principal deformity occurs at the articulation of the calcaneous with the cuboid on the outside of the tarsus, and at the articulation of the astragalus with the scaphoid on the inside of the tarsus, — these two transverse joints forming the medio-tarsal articulation.

No one, I think, will deny that some of the major deformities that occur in congenital equino-varus depend upon the changed relations of the bones of the tarsus at or below the calcaneo-astragalar articulation; and no one, I think, will doubt that the medio-tarsal joint plays an important part in the deformities of club-foot. But I wish to assert that the deformity or deformities which occur at the medio-tarsal joint are neither the most important nor the most difficult to remove. If the medio-tarsal

deformities were all, or the most important ones, found in equino-varus, my experience leads me to say that our results would be uniformly better.

I do not doubt that anatomists are correct in saying that there is no perceptible lateral mobility at the normal ankle joint. But it is, I think, absolutely certain, clinically and pathologically speaking, that a very considerable and a very important displacement of the astragalus occurs in congenital equino-varus, accompanied, in some cases, by an intrinsic deformity of the neck of this bone; and I believe that the most important deformity of congenital equino-varus, as well as the most difficult one to remove, occurs at the very point at which many anatomists tell us it cannot occur.

The astragalus is closely held between the two malleoli; it articulates with the calcaneous and scaphoid bones only, and it is the only important bone of the tarsus which is not directly controlled by muscular action. Lying in its doubly protected position, and held in place by its ligamentous attachments, it can only be reached, when we desire to correct the position it assumes in the condition under consideration, by attacking the bones with which it articulates. All the other bones of the tarsus are reached with comparative ease, but the astragalus can only be reached by an indirect force.

If under these circumstances we divide the plantar fascia and the gastrocnemius and all the other tissues ordinarily divided in the operative treatment of congenital equino-varus, we cannot, as we all know, insure a reduction of the deformity. We may even make a deep, open incision into the plantar tissues, and cut the anterior portion of the internal lateral ligament of the ankle joint and divide the tendo achillis without successfully reaching the displaced and rotated astragalus. Still further, osteotomy may be performed and a large wedge removed from the outer side of the tarsus, and still leave the rotated astragalus unmoved in its deformed position. In brief, I believe that the keystone of the deformity is at the misplaced astragalus, and that if we succeed in replacing it in its normal position, the other deformities become of minor importance and are comparatively easily removed.

What is the position of the astragalus in congenital equino-varus? Sometimes, though we cannot always discover it, especially in young subjects, there is an intrinsic deformity of the head and neck of this bone, due, I am quite sure, in the majority of cases to rapid growth during the latter months of intra-uterine life, after the gastrocnemius has become shortened. But whether this intrinsic deformity exists or not, it is apparent that the acquired position of the astragalus in the condition named is not a simple one.

Rather than attempt to describe the malposition of the astragalus relatively in the condition under consideration, I think it better to study its position from a mechanical standpoint. We can then better understand the indications for treatment.

In response to the irresistible force which is acting upon all the misplaced tarsal bones through the medium of the shortened muscular and fibrous tissues, the astragalus (1) becomes rotated upon a *transverse axis;* that is, the head and neck are tilted downwards as it is in the position of extension of the ankle joint, or as it is in simple equinus. (2) It also becomes rotated upon an *antero-posterior axis*, or under its surface is turned toward the mesial plane of the body upon an axis which corresponds, in general terms, with the long diameter of the foot; and (3) it is rotated upon a *vertical axis*, or the head and neck are twisted toward the mesial plane of the body upon an axis which corresponds with the long diameter of the tibia, aiding in the production of the so-called inversion, or adduction of the tarsus. In a typical case we find all these rotatory elements of deformity present, not only at the astragalus, but also at all the other tarsal bones, producing a compound deformity that so disturbs the normal line of gravity that the patient in walking presents the cuboid bone to the floor.

A brief study of the anatomical construction of the tarsus, bound together as its component parts are by strong ligaments, will, I think, convince any one that the extreme malposition of the cuboid bone (as a matter of illustration), and which is seen in all extreme cases of equino-varus, could not occur except as a result (1) of a dislocation at the calcaneo-cuboid articulation, or (2) a dislocation at the calcaneo-astragalar articulation, or

(3) a malposition of the entire tarsus, accompanied by a greater or less elongation of all the ligaments on the concave side of the deformity, and a changed relation of all the articular tarsal surfaces. It is known that there is no true dislocation of any of the bones of the tarsus under the conditions named. The articular surfaces are disturbed, subluxation to a minor degree is present, and interarticular pressure is concentrated at certain exposed points. It seems evident in these cases that there is, among other things, a loss of relative growth between the muscles and the bones, especially the long bones of the leg, and that the arrested or impaired growth of the gastrocnemius produces a malposition that prevents the foot from assuming a normal position. Growth of the bones, however, goes on; and the result is that the tarsus, like every other complex body, yields in the direction of the least resistance. As the tarsus yields in response to the irresistible force of opposed bony growth, the os calcis, the cuboid, and the scaphoid are pulled, so to speak, from their normal position, dragging the astragalus with them, after their ligaments have been stretched to their utmost capacity. In short, a certain degree of displacement of the astragalus takes place; and this is largely due to the fact that the superior articular surface of the astragalus as well as the lateral facets are free from ligamentous or muscular attachments, and also because the ligamentous attachments of the lateral as well as the anterior and posterior surfaces of this bone are low down, or *below* the centres of rotation to which attention has been called. There is, therefore, no ligamentous or direct muscular resistance to the rotation of the astragalus when the os calcis, the cuboid, and the scaphoid are drawn from their positions. The ultimate point of resistance lies, therefore, at the inferior articular surfaces of the tibia and fibula; and as a result of the great and prolonged pressure which exists, it may be presumed that absorption of the articular cartilage ensues; and this, with the slight rotation of the fibula upon the tibia upon their long axes, accounts for some of the lateral or rotatory movements which the astragalus undergoes in the deformity under consideration. Even absorption of bone may follow; and it is not impossible that the ligamentous structures which bind the fibula and tibia together may yield as

the result of the long-continued pressure, or that, especially in fœtal life, the astragalar neck may become twisted.

Associated with the shortened gastrocnemius in congenital equino-varus, we always have a shortening of the plantar tissues. This plantar shortening fixes the calcaneus in a position where it cannot rotate outward, this latter condition occurring only, as a rule, in flat foot with elongated plantar tissues, or in valgus with a paralysis or weakness of the gastrocnemius. An important feature of congenital equino-varus is therefore an inward rotation of the calcaneus upon an antero-posterior axis, associated with a rotation upon a transverse axis.

After the remarks made upon the nature of the muscular shortening we will assume that the normal longitudinal growth of the gastrocnemius is either arrested or impaired, and that the tibia is not affected to the same extent by the lesion or change which produces the so-called contracture of the muscles. If the tibia outgrows the muscle and as a result of the irresistible force produced by longitudinal osseous growth in the long bones of the leg, a deformity must occur somewhere. In congenital equino-varus it is first seen in the rotation upon a transverse axis and in the complex rotation of the os calcis already referred to. Perhaps the tibialis posticus is also affected, as I think it is in many instances. The plantar tissues certainly are shortened. With these elements at work, the deformity of equino-varus is not difficult to explain from a mechanical standpoint. The whole tarsus is rotated like the keystone (the astragalus) upon the three axes already mentioned. The hinge of this rotation, so to speak, is at the point of the least ligamentous and muscular resistance, the tibio-astragalar articulation; and as a result of the prolonged and uninterrupted pressure, the whole tarsus assumes a position of chronic deformity, the various articulations becoming more rigid as time passes.

It is well to stop here for a moment to point out the conditions which the ligaments of the tarsus assume under these conditions. On the outer aspect of the foot they become elongated; on the inner they soon become very materially shortened. This is especially so at the internal lateral ligament of the ankle joint. All the other ligaments become either lengthened or shortened,

depending upon their location and their relation to the acquired position of the bones to which they are attached, — those on the convex side being elongated, those on the concave side being shortened.

After a time, — but I think after a much longer time than is generally supposed, — the articular surfaces of all the bones involved adapt themselves to the deformed position. My experience leads me to think that it is exceptional for the osseous troubles to reach a point of more than troublesome resistance before puberty, unless there is a considerable intrinsic deformity of the neck of the astragalus; while the ligaments on the other hand become very much shortened, even in babyhood.

I feel, therefore, that we may assume the following as a basis to treat the condition under consideration: First, that there is a compound deformity in equino-varus, due to a rotation of all the bones of the tarsus upon three distinct axes, — that is, transverse, antero-posterior, and vertical; secondly, that this compound deformity is due to a loss of relation between muscular and osseous growth, — not to muscular contraction or contracture, as has generally been supposed; thirdly, that the principal obstacles to a reduction of the deformity are (1) the position acquired by the astragalus with or without an intrinsic deformity of the neck, and (2) the ligamentous shortening; fourthly, that these difficulties are much increased by the progressive ligamentous and osseous changes that occur as the direct result of prolonged malposition; and fifthly, that the deformities of the medio-tarsal joint are secondary in importance to those which occur at the astragalus.

We will now pass to the question of treatment.

In undertaking any plan of treatment we must bear in mind that the whole tarsus is involved, and that any method which restores the astragalus to its normal position promises to be successful; for if we succeed in restoring the normal relations of the astragalus to the tibia, we carry with it (the astragalus) the other bones of the tarsus. My experience proves that it is not the antero-posterior deformities, where rotation occurs upon a transverse axis only, that present difficulties. The real difficulties occur in the so-called "lateral" deformities, where we see

the effects of the compound rotation to which attention has been already directed. In order to make myself better understood, I will again briefly refer to the three varieties of rotation: the first-named, the *transverse*, is shown at the elevated heel; the second, the *antero-posterior*, is evident at the inward rotation of the os calcis; the third, the *vertical*, is seen in the inversion of the entire foot.

The result of the first-named condition, as has already been stated, is easily overcome if it be uncomplicated. The second and third conditions are due largely to the causes which produce the first, and may be considered as secondary to it.

Our first effort, therefore, should be to attack the gastrocnemius shortening in such a way as to overcome its secondary effects; and it must be evident that any method which neglects the gastrocnemius shortening must fail. But the entire tarsus is rotated, and we must not make the error of using the cuboid as a point of resistance to overcome the rotation of the tarsus, for the simple reason that if we do so we at once block the mechanism, whatever it may be, designed to overcome the rotation of the tarsus. The cuboid has taken its acquired position on account of its close relation with the os calcis. The tarsus as a whole should be thrown *downward* and *outward* (reversing the curve of the deformity, which is *inward* and *upward*) on an antero-posterior axis; and this downward and outward rotating force should be applied upon a remote axis until the os calcis and the astragalus fall directly under the tibia, the mechanism being so arranged that the rotation upon a transverse axis is also attacked. We must also remember in treating all these cases, even those seen immediately after birth, that we are not dealing with muscular shortening only. Two other potent factors must be considered; and these are, first, the resistance which exists at the shortened ligamentous structures, and, secondly, a possible or even provable intrinsic deformity at the neck of the astragalus. And it must be remembered that these ligamentous structures soon adapt themselves to the acquired position of the bones of the tarsus. It is surprising how soon these ligaments shorten, and this remark is especially true of the internal lateral ligament of the ankle joint. Any procedure which ignores this

condition or the changed articular surfaces is apt to result in failure; and the difficulty of attacking these shortened ligamentous tissues, especially those upon the internal malleolar aspect of the ankle, is apparent. It is very easy to apply traction to the antero-posterior contractions, of whatever nature; but it has not been so easy heretofore to reach the internal lateral ligamentous contractions or the twisted astragalar neck by this same method of traction, though it seems evident that the resistance of a contracted ligament or a deformed bone is just as important as that of a shortened muscle, and much more difficult to reach. And this principle of lateral traction should not be applied without recognizing the fact that the cuboid bone must rotate downward and outward with the other bones of the tarsus upon a remote centre of motion in removing the deformity of equino-varus. My experience has proved that if the whole foot is rotated outward upon a remote centre by an adequate mechanism, the heel being properly secured, the major deformities become modified very soon.

In my experience the principal obstruction to the reduction of the deformity (excepting, of course, an intrinsic deformity of any of the tarsal bones) exists in the shortened ligamentous tissues which lie between the inner malleolus and the tarsus. I formerly regarded the plantar tissues as being the most obstinate, and they still tease us all. But the internal lateral ligament of the ankle is very strong and dense. It arises from the internal malleolus, and sends its radiating fibres not only to the os calcis and scaphoid, but to the astragalus as well. This ligament is always shortened in congenital equino-varus, and the tarsal bones to which it is attached are imprisoned in their acquired positions until the contracted positions of the ligament are elongated. I regard this ligamentous resistance as being far more important than the gastrocnemius or plantar shortening. If we can find some means to overcome this shortening of the internal lateral ligament, I am sure we will find that the duration of the treatment of congenital equino-varus will be very materially shortened, and much better and far more permanent results will be secured.

The apparatus I will show you on this occasion treats the in-

ternal, lateral, and other ligamentous resistance exactly as the gastrocnemius is treated in our efforts to overcome the antero-posterior contractions of equinus with the antero-posterior traction shoe.[1] The aim of this new traction apparatus is to bring the rotated tarsus, as a whole, and by a very simple movement, directly under the inferior articulating surface of the tibia, attacking not only the post-tibial resistance, but also and especially the stubborn shortening of the internal lateral ligament, as well as all the other contracted tissues upon the inner or concave side of the deformity. If the neck of the astragalus is twisted, a very great force is applied to it in the right direction. I had previously attempted to accomplish these ends by a pushing force acting from the inner side of the foot (the internal lateral traction shoe). But experience proves, in a very limited number of cases, that it is difficult to apply the rotating force accurately when using this internal lateral stretcher; and it was also found that the rotation of the cuboid was sometimes arrested by the mechanism of the apparatus before it fell into its proper position. And it may be that a sufficient force could not be obtained in cases where there was an undiscovered twist at the neck of the astragalus, — a criticism which cannot be made of the external traction shoe, which can be made a "crusher" if necessary.

In the apparatus I now show you, while sufficient pressure is exerted upon the cuboid, by a simple retention strap, to make it a simple point of resistance, the apparatus is so arranged that the whole tarsus is rotated *downward* and *outward* to any desired extent; and a direct pressure is exerted in the right direction upon the twisted astragalar neck, if any deformity exists at that point.

In Fig. 87 there is shown a schematic engraving of the external lateral traction apparatus, illustrating its application to a condition of equino-varus of the left foot, and its movement upon a remote antero-posterior axis. The centre of motion is at the point A, remote from the tarsus and outside of, but directly over, the external malleolus. The anterior portion of the foot rests upon the foot-piece B, inside of the curved lateral plate C,

[1] Vide "The Use of Traction in the Treatment of Club-Foot," New York Medical Journal, March 5 and March 12, 1887.

which grasps the inner aspect of the foot at the junction of the first metatarsal bone with the first phalanx of the great toe. The heel is retained by the conventional astragalar retention strap, and the heel traction strap of the antero-posterior traction apparatus. The foot-plate of the apparatus is removed posterior to the point which corresponds with the junction of the tarsus and metatarsus, leaving an open and unobstructed space for the descent of the heel where traction is applied. The necessary arrangements to secure the heel, etc. (not shown in this engraving), are the same as those used in the application of the anteroposterior traction shoe which is described in full in the "New York Medical Journal" for March 5 and March 12, 1887.

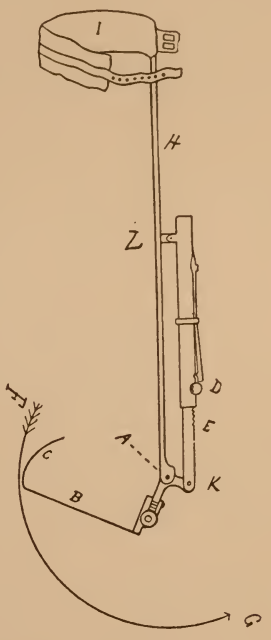

FIG. 87.

The foot being secured by the straps referred to, in the apparatus now under consideration, in its deformed position (at the angle, for example, shown in Fig. 87), a key (A, Fig. 88) is introduced at the cylinder D and the extension rod E is *shortened*. The entire foot-piece of the apparatus is thrown downward and outward by this movement, in the direction of the curved arrow F, G, upon the remote centre A; and the foot, properly secured in the apparatus, follows the same movement.

The foot mechanism is attached to a straight, strong steel bar H, and this side bar is surmounted by a conventional calf band I, which is made to closely encircle the calf at a point just below the knee joint. The *retraction* rod is attached to the side bar at L. In varus this side bar, H, is placed on the outside of the leg; in valgus on the inside. In difficult cases this side bar may be continued upward so as to include both leg and thigh, with a perineal pad to afford a point of counter-resistance to the force applied below. But in any event, and in order to secure a proper

adjustment of the apparatus and to exert an adequate force in the right direction, the leg piece of the side bar, H, should lie directly over the fibula, and at least one inch away from it at the external malleolus in the treatment of equino-varus.

Fig. 88 gives a side view of the apparatus, and illustrates the action of the apparatus upon a transverse axis.

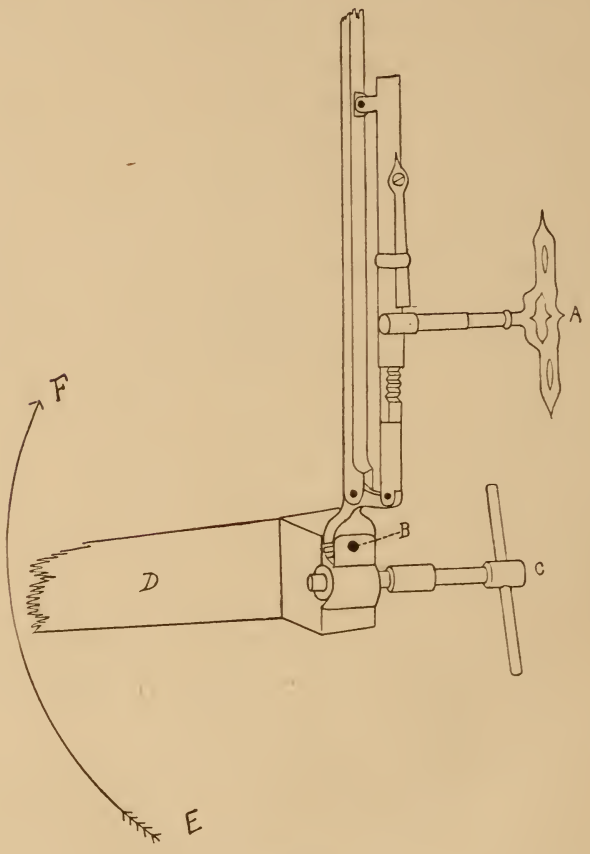

Fig. 88.

The centre of motion on a transverse axis is at the point B; the key C acting on a worm and screw which lowers or elevates the anterior part of the apparatus D. The foot being retained in the apparatus by the astragalar and heel retention straps

already referred to, and secured in the exact position of the deformity, the initial force is applied by turning the key C so as to move the anterior part of the apparatus D in the direction indicated by the curved arrow E, F, until a considerable resistance is offered by the shortened tissues of the foot. Then the key A is used, the outside *retraction* bar and rod are forcibly shortened, and the whole foot rotates downward and outward as indicated by the curved arrow F, G, in Fig. 87.

The curved lateral plate C (Fig. 87) can be moved at will and secured by a key and clamp in any desired position, thus meeting any ordinary amount of inversion of the anterior portion of the tarsus. In short, it is not ordinarily necessary to make any special provision for the rotation of the tarsus upon a vertical axis. When, however, any special mechanism is necessary, that attached to the foot plate of the "internal lateral traction apparatus" (described in full in the New York Medical Journal, March 5 and 12, 1887) meets all the indications. In some cases I have used this attachment with advantage; but in almost every case the vertical rotation has yielded to the combined force represented in the accompanying engravings.

In ordering this apparatus, the centre (A, Fig. 87) can be placed at any desired point; and its position will vary with the extent of the deformity, the amount of force required, etc. The same remark applies to the arm (A, K, Fig. 87), which can be lengthened or shortened as occasion demands. It is easy to see that with the combined force exerted by both these powerful levers an osteoclast could easily be constructed, and I am now having one made with this end in view.

I am indebted to my friend Dr. Charles L. Scudder, of Boston, for his assistance in the preparation of the engravings which accompany this paper, as I also am for his recent contribution to the etiology of club-foot.